Indian Journal of Economics and Development

Volume 14
No. 1a
April, 2018

Print ISSN 2277-5412
Online ISSN 2322-0430

Society of Economics and Development
www.soed.in

Society of Economics and Development

Objectives of the Society

i. to promote awareness on the issues relating to economic development,
ii. to promote better social and ethical values to promote development,
iii. to promote economic prosperity and serve as a tool to create the consciousness for development,
iv. to conduct research and publish reports on economic issues,
v. to organize seminars, symposia, workshops to discuss the economic problems, and
vi. to offer consultancy, liaison and services as a facilitator.

Membership type	***Subscription Rates***	
	India (₹)	***Other Countries ($)***
Academics (Faculty and Students)		
Annual	1000.00	30.00
Life	5000.00	300.00
Institutional		
Annual	3000.00	300.00
Corporate		
Annual	5000.00	500.00

Kindly login www.soed.in to remit membership fee via CCAvenue

Print ISSN 2277-5412
Online ISSN 2322-0430

Indian Journal of Economics and Development

5th National Seminar
on
Towards Sustainable Agriculture
Role of Technology, Policy Planning and Implementation

at
Punjab Agricultural University, Ludhiana

on
April 05, 2018

Organized by
The Society of Economics and Development

in collaboration with
National Council of State Agricultural Marketing Boards
New Delhi

Society of Economics and Development
www.soed.in

Indian Journal of Economics and Development
Volume 14 (1a) April, 2018

Printed and Published by Dr. Parminder Kaur on the behalf of the Society of Economics and Development

Email: chiefeditorijed@gmail.com
Website: http://soed.in/
Journal is available on www.indianjournals.com

Printed at FOIL PRINTERS
2051, Gobind Nagar,
Ludhiana-141 001
Phone: 0161-2404093
Email: foilludhiana@gmail.com

PREFACE

Concerns about sustainability in agricultural system focuses on the need to develop technologies and practices that do not have adverse effects on environmental goods and services, are accessible to and effective for farmerslead to the improvements in food productivity. Despite great progress in agricultural productivity in the past half-century, with crop and livestock productivity strongly driven by increased use of fertilizers, irrigation water, agricultural machinery, pesticides,and land, it would be over-optimistic to assume that these relationships will remain linear in the future. New approaches are needed that will integrate biological and ecological processes into food production, minimize the use of those non-renewable inputs that cause harm to the environment or to the health of farmers and consumers, make productive use of the knowledge and skills of farmers, so substituting human capital for costly external inputs, and make productive use of people's collective capacities to work together to solve common agricultural and natural resource problems, such as for pest, watershed, irrigation, forest and credit management. Agriculture plays a crucial role in sustainable development and in hunger and poverty eradication. The challenges faced by agriculture in sustainable development for working out ways of bringing about a society that is materially sufficient, socially equitable, and ecologically sustainable and one that is not obsessed by growth only but motivated by satisfying human needs and equity in resource allocation and use. Sustainable agriculture must meet economic, social and ecological challenges. All these challenges are closely related. These features of sustainable agriculture should be considered as a package, and no single feature should predominate over the others. The main tools towards sustainable agriculture are policy and agrarian reform, participation, income diversification, land conservation and improved management of inputs, this seminar is an effort to identify the strategies, guidelines,and practices that constitute the concept of sustainable agriculture which will clarify the research agenda and priorities thereof, as well as suggest practical steps that may be appropriate for moving towards sustainable agriculture.

Keeping the above scenario in view, the Society of Economics and Development has selected the theme *Towards Sustainable Agriculture: Role of Technology, Policy Planning,and Implementation* for its 5th National Seminar being organized at Punjab Agricultural University, Ludhiana on April 05, 2018.

There has been an overwhelming response from the researchers for the Seminar and the Society appreciates and acknowledges the interest shown by the researchers in the Seminar. A total of 150 full research papers were received and after thorough screening 99 articles were selected for presentation in the Seminar and are being published in the seminar issue of The Indian Journal of Economics and Development.

The Society is grateful to Dr. B.S. Dhillon, Vice Chancellor of Punjab Agricultural University, Ludhiana for giving his consent to host the 5th National Seminar and providing all the logistic support.

The Society is thankful to Dr. J.S. Yadav, Managing Director, National Council of State Agricultural Marketing Boards, New Delhi for providing financial support for meeting the expenditure for organizing the 5th National Seminar. The financial help received from Punjab Mandi Board is gratefully acknowledged. The Society is thankful to Mr. Harpreet Singh Sidhu, General Manager, Punjab Mandi Board for help and support.The Society is highly grateful to Mr. Bal Mukand Sharma, Additional Managing Director (D), MARKFED, Chandigarh for providing financial support for organizing the 5th National Seminar.

The Society is grateful to Dr. Simran Kang Sidhu, Professor of Sociology, Department of Economics and Sociology, PAU, Ludhiana, for taking the responsibility of Organizing Secretary, 5th National Seminar. The Society is thankful to Dr. H.S. Dhaliwal, Director, Punjab Agricultural Management and Extension Training Institute, PAU Campus, Ludhiana for providing facilities for the Seminar.

The Office Bearers of the Society of Economics and Development and Members of the Editorial Board of The Journal 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, Chief Editor and all the eminent researchers who have reviewed the articles submitted to *The Journal of Economics and Development.* Their contributions to the enrichment of the journal are thankfully acknowledged. The help rendered by Dr. K.K. Chahal, Punjab Agricultural University, Ludhiana is duly acknowledged. I am particularly grateful to Dr. Maan Singh Toor, President, Society of Economics and Development for providing guidance and help.

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 5th National Seminar.

Dated: March 25, 2018

(Dr. Parminder Kaur)
General Secretary

Indian Journal of Economics and Development
(Journal of the Society of Economics and Development)

Volume 14 **April, 2018** **No. (1a)**

Contents

Economics of Crop Production, Technology, and Sustainability

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 1-12
DOI: 10.5958/2322-0430.2018.00027.6

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Impact of Neem-coated Urea on Production, Productivity and Soil Health in Punjab

D.K. Grover, J.M. Singh, Sanjay Kumar and Jasdev Singh*

Agro-Economic Research Centre, Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141004

**Corresponding author's email: jmsinghpau@rediffmail.com*

Received: October 31, 2017 *Manuscript Number: NS-18-10* *Revision Accepted: January 26, 2018*

ABSTRACT

The present study was undertaken to analyze the trends in usage and prices of urea in Punjab, to analyze the adoption behavior of neem coated urea (NCU) among selected farmers, to analyze the impact of adoption of NCU on crop productivity and farmers' income and to suggest suitable policy measures for adoption of NCU. The data were collected from randomly selected 200 farmers from four blocks of Ludhiana and Patiala districts where paddy is a major kharif crop which requires adequate doses of urea for its growth. The results of the study revealed that the consumption/ sale of urea in Punjab during the year 2007-08 was 2646.44 th. MT which rose to 3086.05 th.MT during the period 2007-08 to 2015-16 at an annual growth rate of 1.64 percent. The urea prices increased significantly at the highest growth of 5.21 percent per annum during the decade 1990-91 to 1999-2000 while during the period 1980-81 to 2015-16 the growth in urea prices was 3.33 percent per annum. The analysis of the primary data revealed that the majority of the respondent farmers purchased NCU and Normal urea (NU) from co-operative societies followed by private fertilizer dealers while the cost per bag of NCU, including transportation cost, worked out to be ₹289.69 while it was ₹276.58 per bag in case of NU. There was marginal increase in the productivity of paddy crop during the year 2015-16 as compared to the year 2014-15. The net returns per acre were estimated to be ₹31401 during the year 2015-16 and ₹29530 in 2014-15. As far as awareness about NCU was concerned, almost all the selected farmers were aware about the NCU and major source of awareness was co-operative societies. There was a significant increase in the application of NCU after 2015-16 in crops such as; paddy, wheat, basmati, sugarcane, potato, maize, sunflower,and vegetables. Due to the application of NCU, only 5.29 percent farmers reported about the increase in paddy yield while the cost of pest and disease control declined by 21 percent. There was increase in productivity of paddy crop where neem coated urea (NCU) was applied on the sample farms. Also, the NCU usage on the sample farms increased while cost of pest and disease control measures declined. The partial budgeting technique brought out that there were added returns of ₹718 per acre by application of NCU on the sample farms. It was also revealed by all the respondents that there was no change in the texture of the soil, soil moisture retention capacity, water infiltration rate, soil softness and decline in the compaction of the soil due to application of NCU but there was higher retention of nitrate in the soil and thereby its slow release to the crop.Also, the NCU usage on the sample farms increased while cost of pest and disease control measures declined. High price of NCU, inadequate/ shortage of supply during peak season and poor quality of NCU in some of the co-operative societies were the major problems reported by the respondents. Major suggestions were; assured/ timely and adequate supply of NCU to co-operative societies and organizing training camps for spreading awareness. Major policy issue suggested was to lay emphasis on ensuring good quality, adequate quantity and timely supply of NCU along with bringing its price at par with NU.

Keywords
Growth, impact, neem coated urea, production, trends.

JEL Codes
C81, Q12, Q16.

INTRODUCTION

Punjab state is well known for adoption of new farm technology which resulted in advent of green revolution thereby increasing dramatically the productivity and production of crops especially paddy and wheat. With the passage of time, rice-wheat cropping pattern resulted in appearance of macro and micro-nutrients deficiencies in the soil, resulting into an excessive application of chemical fertilizers as source of nutrients for plant growth. The total consumption of nitrogenous (N),

phosphatic (P) potassic (K) fertilizers in the Punjab state increased from 2.13 lakh tonnes in 1970-71 to 17.14 lakh tonnes in 2013-14 (Economic Advisor, 2014). The per hectare consumption of these fertilizers (kg)in the state has increased merely from 43.12 N, 7.75 P and 1.73 K in 1970-71 to 329.15 N, 78.31 P and 5.54 K during the year 2013-14.The increased consumption of chemical fertilizers, which was a boon for increase in agricultural productivity in the state, has now become a bane due to the problems associated with its excessive use.

India is the second largest consumer of fertilizer in the world next to China and third largest producer of nitrogenous fertilizer behind China and USA. In terms of nutrients, it stands second in consumption of N and P with the quantity of 16.75 million tonnes and 5.63 million tonnes, respectively. Total consumption of NPK fertilizers in the country during 2013 was 24.48 million tonnes (IFA, 2015). Urea is the most common nitrogen fertilizer used uniformly throughout the world. The wide acceptance of urea is because of its agronomic acceptability and relatively lower cost as compared to other fertilizers. Besides being widely used as an excellent fertilizer for plant growth, it can also be used among numbers of products such as animal feed, commercial products, glue, resin, cosmetics, pharmaceuticals, dish soaps, hair conditioners, tooth whiteners, etc.

With the increased cost of urea fertilizer and concern about its adverse environmental impact of nitrogen losses, there has been a great interest in improving the Nitrogen Use Efficiency (NUE) through optimization of nitrogen use. By doing so, higher yields can be achieved with less negative impacts like nitrogen leaching (Agostini *et al*., 2010; Burns, 2006; Neeteson *et al.*, 1999; Rahn, 2002).

Keeping in view the low NUE, it has been felt to find out the use of some indigenous material and coating process for reducing the nitrogen losses from urea. In this endeavor, National Fertilizer Limited (NFL) standardized the techniques for production of Neem Coated Urea (NCU) in 2002. Since then many changes have been made in the process and applicant solution to have uniform and consistent coating of neem oil on urea prills and to maintain the concentration of Neem oil content as per the specification prescribed in Fertilizer Control Order (FCO), 1985. The use of NCU has been found to improve the uptake of N, P and K significantly. Based upon the results of extensive field trials, NCU was found to be agronomically superior to normal prilled urea.

Neem acts as a nitrification inhibitor and its coating over urea minimizes loss due to leaching. Coating urea with neem prevents its misuse as well as puts the fertilizer in slow release mode thereby nourishing the saplings for a longer period. This avoids the repeated use of fertilizer and economize the quantity of urea required by crops (enhancing Nitrogen-Use Efficiency (NUE)). Besides, coating of neem oil also reduces the leaching of nitrates into the groundwater aquifers and thus, help in reducing its pollution.

Punjab state being called food bowl of the country is also one of the largest consumer of chemical fertilizers in the country. So, it is necessary to lay emphasis on judicious use of fertilizers especially urea. The Government of India included neem coated urea, a slow release fertilizer, in the Fertilizer (Control) Order, 1985 and made it mandatory for all the indigenous producers of urea to produce their whole production of subsidized urea as NCU from 2015. There is a need to assess the impact of NCU on the production and productivity of major crops in Punjab. The specific objectives of the study were as follows:

i. to analyze the trends in usage and prices of Urea in Punjab,
ii. to analyze the adoption behavior of neem coated urea (NCU) among selected farmers in Punjab,
iii. to analyze the impact of adoption of NCU on crop productivity and farmers' income, and
iv. to suggest suitable policy measures for adoption of NCU.

METHODOLOGY

The present study relied on both primary and secondary data collected from various sources. The reference period for the study was *kharif*, 2015. Paddy crop in *kharif* season having highest use of urea in Punjab was selected for the study. Two districts namely Ludhiana and Patiala were selected based on the urea usage in paddy crop in the central belt of the state. From each selected district, two blocks were selected again based on the same criterion. Thus, Jagraon and Machhiwara blocks from district Ludhiana and Nabha and Rajpura blocks from district Patiala were selected for the study. Further, from each block, two cluster of villages comprising 3-4 villages were selected for conducting the survey. A sample of 50 farmers from each block, which added up to 100 farmers in each district, totalling to 200 farmers for both the selected districts. Households were selected randomly for assessing the use of NCU fertilizer and its impact on crop production. While selecting the households, special care was taken to have the representation of the farmers with full use of NCU, part use of NCU and no use of NCU (those who have used simple urea). Thus, a total number of 200 NCU/partial NCU and Urea user farmers for paddy crop were interviewed. Adequate representation was given to different farm size groups classified based on operational land holding size. Hence, the sample includes 68 marginal/small, 117 medium and 15 large farm size groups.

RESULTS AND DISCUSSION

The results have been discussed under the following heads:

I. Trends in urea consumption in the Punjab state
II. Adoption behavior of NCU among farmers
III. Impact of adoption of NCU on crop productivity and farmers income
IV. Conclusions and policy issues

Trends in Urea Consumption in the Punjab State

Trends in urea consumption and price variation

The district wise trends in consumption/ sale of urea in Punjab have been given in Table 1. It was observed that during the year 2007-08 the consumption of urea was 2646.44 thousand MT which rose to 3086.05 thousand MT during the period 2007-08 to 2015-16 at an annual growth rate of 1.64 percent. As far as district-wise analysis is concerned, the annual growth in urea consumption was 5.78 percent in S.A.S., Nagar followed by 3.60 percent in Rupnagar, 3.34 percent in Barnala, 2.43 percent in Moga, 2.62 percent in Kapurthala, 2.11 percent in Tarn Taran, 2.07 percent in Jalandhar, 2.02 percent in Amritsar and 1.71 percent in Firozpur and it was also statistically significant. In rest of the districts, although there was also growth in urea consumption but it was not significant statistically. So, it is clear from the analysis that growth in urea consumption was higher in those districts where mostly paddy-wheat crop rotation is followed by the farmers. These crops require sufficient doses of urea along with other fertilizers for overall plant growth and good productivity. In relative terms (Table 2.1b) the consumption/ sale of urea was 10.72 percent of total consumption in district Firozpur during 2015-16 followed by other major consuming districts, that is, Sangrur (9.76 percent), Ludhiana (7.92 percent), Patiala (7.49 percent) and Bathinda (6.57 percent).

The trends in urea prices since 1981-82 to 20015-16 have been given in Table 2. A perusal of the table reveals that during the year 1980-81 the price of urea was ₹2350 per tonne which declined to ₹2150 per tonne in 1982-83 and again rose to ₹2350 per tonne during 1985-86. After remaining at this level for continuous four years the price of urea again shoot up to ₹3227 per tonne in 1990-91 but again declined to ₹2760 per tonne in the subsequent year and remained at this level for next four years, that is, up to the year 1995-96. From the year 1996-97, the price of urea increased to ₹3660 per tonne and remained increasing for

Table 1. District-wise trends in consumption/sale of urea in Punjab, 2007-08 to 2015-16

(000'MT)

District	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	CGR (Percent)
Firozpur	281.61	269.28	264.49	280.51	299.19	309.4	275.05	287.53	330.95	1.71*
Sangrur	253.41	268.42	230.12	271.71	280.76	267.54	251.65	260.84	301.21	1.29
Ludhiana	210.73	204.08	192.39	224.73	222.4	224.96	208.67	214.69	244.41	1.53
Patiala	221.03	199.77	196.52	212.55	226.08	220.18	211.77	204.56	231.00	0.72
Bathinda	159.78	167.18	155.1	175.09	175.34	185.18	162.82	176.49	202.61	2.13**
Moga	146.13	140.67	130.65	143.19	154.59	154.74	145.45	154.65	181.41	2.43**
Amritsar	160.45	137.78	138.12	145.63	153.91	162.7	149.54	161.37	179.84	2.02**
Gurdaspur	160.17	164.37	153.65	166.11	173.99	169.03	149.68	155.43	170.25	0.07
Sri Muktsar Sahib	158.86	140.85	147.01	148.93	167.25	164.64	147.01	163.22	167.53	1.27
Jalandhar	136.54	132.15	127.42	145.28	146.55	150.96	139.13	152.16	158.37	2.07***
Tarn Taran	114.45	108.35	104.78	116.19	120.47	124.5	114.45	117.43	138.67	2.11**
Mansa	127.7	118.12	118.33	137.6	128.75	129.27	126.94	128.78	138.4	1.1
Barnala	75.75	91.19	83.93	96.5	99.87	99.39	94.61	92.25	114.97	3.34***
Faridkot	90.99	96.03	76.99	95.39	95.43	101.24	81.02	92.26	105.00	1.03
Kapurthala	82.92	78.02	78.97	86.4	87.81	89.34	90.53	90.83	101.01	2.62***
Hoshiarpur	82.93	81.4	77.04	82.26	86.72	87.68	81.97	83.63	99.91	1.70**
Fatehgarh Sahib	71.86	67.07	65.3	67	70.88	70.21	67.01	68.39	75.61	0.6
Shaheed Bhagat Singh Nagar	50.91	51.08	49.83	54.43	58.43	55.8	49.01	52.95	60.13	1.28
Rupnagar	33.39	33.79	32.84	36.35	39.69	38.08	37.36	40.61	45.83	3.60***
Sahibzada Ajit Singh Nagar	26.84	27.32	22.29	34.59	37.58	38.14	35.66	36.19	38.94	5.78***
Punjab state	**2646.44**	**2576.9**	**2445.76**	**2720.44**	**2825.7**	**2842.97**	**2619.32**	**2734.26**	**3086.05**	**1.64****

Source: www.urvarak.in.
**** and ** significant at one and five percent level.*

Table 2. Trends in prices of urea, 1980-81 to 2015-16

Year	Price (₹/tonne)
1980-81	**2350**
1981-82	2350
1982-83	2150
1983-84	2150
1984-85	2150
1985-86	2350
1986-87	2350
1987-88	2350
1988-89	2350
1989-90	2350
1990-91	**3227**
1991-92	2760
1992-93	2760
1993-94	2760
1994-95	2760
1995-96	2760
1996-97	3660
1997-98	3910
1998-99	4000
1999-2000	4600
2000-01	**4600**
2001-02	4830
2002-03	5070
2003-04	5070
2004-05	5070
2005-06	5070
2006-07	5070
2007-08	5070
2008-09	5070
2009-10	5310
2010-11	**5310**
2011-12	5360
2012-13	5360
2013-14	5360
2014-15	5360
2015-16	5628
CGR (percent)	**3.33**

Source: www.indiastat.com.

Table 3. Compound growth rate of prices of urea, 1980-81 to 2015-16

Period	Compound growth rate (percent per annum)
1980-81 to 1989-90	0.49
1990-91 to 1999-00	5.21**
2000-01 to 2015-16	0.92**
1980-81 to 2015-16	3.33**

*****Significant at one percent level of significance.***

next three years and was ₹4600 per tonne during the year 2000-01 and further increased to ₹4830 in the subsequent year. The price of urea remained at the level of ₹5070 per tonne from 2002-03 to 2008-09 and increased to₹5310 per tonne in 2009-10 and remained at the same level for the next year. Again, urea price increased to ₹5360 per tonne in 2011-12 and remained same for the next three years and increased to ₹5628 per tonne in the year 2015-16.

The compound growth rate of urea prices from 1980-81 to 2015-16 has been shown in Table 3. It was observed that the prices of urea increased at an annual growth rate of 0.49 percent during the period 1980-81 to 1989-90 but this increase was not significant. It can be seen that prices of urea increased significantly at a growth rate of 5.21 percent per annum during the period 1990-91 to 1999-2000. Also, from the year 2000-01 to 2015-16 prices of urea increased significantly at an annual growth of 0.92 percent per annum. In overall, the prices of urea increased significantly at an annual growth rate of 3.33 percent during the period 1980-81 to 2015-16.

Adoption Behavior of NCU among Farmers

Details of operational land holdings

The details of average holding size of the sample households have been depicted in Table 4. A perusal of the table reveals that net operational area on the sample farms was 3.13 acre on marginal and small, 12.28 acre on medium, 36.70 acre on large and 11.00 acre in overall. The leased-in land in total was 3.76 acre as compared to leased-out land which was just 0.02 acre on the sample farms. The entire operational area on the sample farms was irrigated and rental value of leased-in land was

Table 4. Average operational land holdings of the sample households in Punjab, 2015-16

(Acre)

Particulars	Marginal and Small	Medium	Large	Overall
Owned land	2.84	8.17	20.17	7.26
Leased-in	0.35	4.10	16.53	3.76
Leased-out	0.06	0.00	0.00	0.02
Operational Area	3.13	12.28	36.70	11.00
percent Irrigated	100.00	100.00	100.00	100.00
Rental value of leased-in land (₹/acre)	37667	37063	37115	37134
Rental value of leased-out land (₹/acre)	40000	-	-	40000

₹37134 per acre in total while it was slightly higher (₹37667) on marginal and small farms as compared medium and large farm categories. The rental value of leased-out land was ₹40000 per acre on the sample farms.

Cropping pattern and sources of irrigation

The sources of irrigation on the sample households in Punjab have been shown in Table 5. A perusal of the table reveals that on 79 percent farms, the source of irrigation was only tube well/ bore well while on the remaining 21 percent farms both tube well and canal irrigation was available.

The cropping pattern of the paddy respondents during *kharif* season in Punjab has been depicted in Table 6. It can be seen from the table that 81.99 percent of the operational holdings on marginal and small farms was under paddy crop while it was 85.37 percent on medium and 86.19 percent on large farms. Another major crop grown on the sample farms was basmati occupying 6.18 percent of the operational holding on large farms followed by 4.66 percent on medium and 1.76 percent on marginal and small farms. Considerable area was under *kharif* fodder (14.27 percent of total operational area on marginal and small farms, 7.50 percent on medium and 3.45 percent on large farms was under *kharif* fodder. Other important crops grown on the sample farms were; maize, sugarcane, and vegetables. Thus, major share in operational area of crops grown during *kharif* season was under paddy and basmati crops.

Purchasing pattern and sources of purchasing of urea

The purchase pattern of NCU on the sample farms for the year 2015-16 in Punjab has been depicted in Table 7. It can be seen from the Table 7 that NCU quantity bought by the selected households was quite high. It was 1216 kg of NCU and 108 kg of NU. The price of NCU was ₹285 per 50 kg bag while it was ₹271 per bag in the case of NU. The distance covered by the households to fetch NCU was less, that is, 2.70 km for NCU and 2.98 km for NU which showed the availability of NCU at a nearby place than NU. The transportation cost incurred per bag (50 kg.) for NCU was ₹4.69 while it was ₹4.95 in the case of NU. Thus, the total cost per bag of NCU worked out to be ₹289.69 while it was ₹276.58 per bag in the case of NU.

The source of purchase of NCU/ NU in Punjab has been shown in Table 8. A perusal of the table reveals that 69.18 percent of respondents purchased NCU from co-operative societies, 23.90 percent from both private dealers and co-operative societies while 6.92 percent purchased exclusively from private fertilizer dealers. On

Table 5. Sources of irrigation on the sample households in Punjab, 2015-16

Particulars	Percent
Borewell/Tube well only	79.00
Both tube well and canal	21.00
Total	**100.00**

Table 7. Purchase pattern of urea per household during 2015-16 in Punjab

Particular	NCU	NU
Quantity bought (kg)	1216	108
Price ₹ per bag of 50kg	285	271
Distance from farm (km)	2.70	2.98
Transport cost (₹ per bag of 50kg)	4.69	4.95
Total cost (₹ per bag of 50kg)	289.69	276.58

Table 6. Cropping pattern of respondents during *kharif* season in Punjab, 2015-16

(Acre)

Crops	Marginal and Small	Medium	Large	Overall
Paddy	2.56 (81.99)	10.49 (85.37)	31.64 (86.19)	9.38 (85.25)
Basmati	0.055 (1.76)	0.57 (4.66)	2.27 (6.18)	0.52 (4.76)
Maize	0.004 (0.12)	0.03 (0.28)	0.00 (0.00)	0.02 (0.19)
Sugarcane	0.00 (0.00)	0.04 (0.31)	1.03 (2.91)	0.10 (0.93)
Kharif Fodder	0.45 (14.27)	0.92 (7.50)	1.29 (3.45)	0.79 (7.15)
Vegetables	0.058 (1.86)	0.23 (1.88)	0.07 (0.18)	0.16 (1.45)
Others (poplar)	-	-	0.40 (1.09)	0.03 (0.27)
Total sown area (Acres)	3.13 (100.00)	12.28 (100.00)	36.70 (100.00)	11.00 (100.00)

Figures in parentheses are percentages of total sown area.

the other hand, in case of NU, 90.91 percent respondents purchased it from co-operative societies and 9.09 percent from private fertilizer dealers. There were 53.33 percent farmers who purchased both NCU and NU fertilizers from co-operative societies and remaining 46.67 percent from both private dealers and cooperative societies. Thus, majority of the respondent farmers purchased NCU and NU from co-operative societies followed by private fertilizer dealers.

Input usage and profitability of paddy crop

The input use, output and returns per acre realized by paddy farmers in Punjab have been depicted in Table 9. It can be seen from the table that during the year 2015, the hired labor charges, which included ploughing charges till planting and transplanting charges of paddy, was found to be ₹2385 per acre while it was ₹2224 during the year 2014.Second major cost component was ploughing and sowing charges (only machinery) which worked out to be ₹2340 during the year 2015 and ₹2215 in 2014. Expenses on plant protection measures being another constituent of total paid out costs, was estimated to be ₹1918 per acre during the year 2015 and ₹1897 in 2014 while for urea/

Table 8. Sources of purchase of NCU/Normal Urea in Punjab, 2015-16

Particulars	Percent farmers		
	NCU (n_1=159)	NU (n_2=11)	Both (n_3=30)
Private fertilizer dealers	6.92	9.09	0.00
Co-operative societies	69.18	90.91	53.33
Both private dealers and co-operative societies	23.90	0.00	46.67
Total	100.00	100.00	100.00

Table 9. Input use, output and returns realized by paddy farmers in Punjab

(₹/acre)

Particular	2015-16				2014-15			
	Marginal and Small	Medium	Large	Overall	Marginal and Small	Medium	Large	Overall
Input use/ costs								
Ploughing and sowing charges (only machinery)	2415	2317	2177	2340	2286	2191	2080	2215
Seed cost/ purchase of seedlings	284	286	271	284	251	279	241	266
Organic/FYM	131	53	-	76	113	43	-	64
Urea/NCU	726	756	700	741	720	785	724	758
Chemical fertilizers (Other than Urea/NCU)	627	636	753	642	548	594	674	584
Plant protection chemicals	1785	1989	1963	1918	1735	1982	1967	1897
Irrigation charges	353	503	565	457	508	785	778	690
Harvesting and threshing charges	1024	1029	1013	1026	974	979	977	977
Hired labour charges (including ploughing charges till planting, cost or sowing/ transplanting)	2379	2387	2567	2385	2216	2226	2233	2224
Imputed value of family labour	121	54	14	74	132	54	14	78
Hired labour (amount paid)	227	315	389	291	229	292	349	275
Maintenance costs on assets used for the reference crop	102	261	138	198	84	240	162	181
Total paid-out costs including imputed value of own labour	10174	10586	10550	10432	9796	10451	10199	10209
Returns								
Output (Main product) (q)	28.62	28.85	29.87	28.85	27.84	28.53	29.73	28.39
By product	-	-	-	-	-	-	-	-
Gross returns	41496	41839	43307	41833	38976	39942	41627	39740
Net returns	31321	31253	32756	31401	29180	29491	31427	29530

NCU the corresponding costs were estimated to be ₹741 during 2015 and ₹758 in the year 2014 and harvesting charges for paddy crop worked out to be ₹1026 during 2015 and ₹977 in the year 2014, respectively. The output of the paddy crop was estimated to be 28.85 quintals per acre in 2015 while it was 28.39 quintals during the year 2014. Gross returns from paddy crop worked out to be ₹41833 per acre during the year 2015 while it was ₹39740 in 2014. The net returns from paddy were estimated to be ₹31401 during the year 2015 and ₹29530 in 2014 on the sample farms.

Awareness and sources of information on NCU

The awareness and source of information about NCU among the respondent farmers has been given in Table 10. A perusal of the Table 10 reveals that all the large farmers were aware about the NCU while 99.15 percent medium and 98.53 percent marginal and small farmers were also aware of it. The major source of awareness concerning NCU was co-operative societies as 85.29 percent marginal and small, 81.20 percent medium and 55.34 percent large farmers revealed co-operative society being a source of awareness. Input shop was second major source of information about NCU which was reported by 33.33 percent large, 9.41 percent medium and 4.42 percent marginal and small farmers. Fellow farmers were also another source of awareness about NCU as revealed by 13.33 percent large, 8.82 marginal and small and 6.84 percent medium category farmers. Also, print and visual media, agricultural university were also sources of awareness as revealed by some of the medium category farmers. In overall, co-operative societies followed by input shop and fellow farmers were the major sources of awareness about NCU.

Status of application of urea versus NCU

The application of NCU across different seasons by paddy respondents in Punjab has been shown in Table 11. It can be seen from the table that there was a significant increase in the application of NCU during 2015-16. In the year 2014-15, there were 81.50 percent respondents who applied NCU to their paddy crop while during 2015-16 this number increased to 94.50 percent on the sample farms. Similarly, in case of wheat crop, only 20 percent farmers applied NCU during 2014-15 while this number swelled to 96 percent in the year 2015-16. In case of other crops such as; basmati, sugarcane, potato, maize, sunflower, and vegetables also the number/percent of respondents applying NCU has also increased as revealed by the respondent farmers. Thus, in aggregate the application of NCU to almost all the crops sown on the sample farms has increased.

Table 11. Application of NCU across different seasons by paddy respondents in Punjab, 2015-16

(Percent of farmers)

Name of the crops	2014-15		2015-16	
	No	Percent	No	Percent
***Kharif* season**				
Paddy	163	81.50	189	94.50
Basmati	1	0.50	22	11.00
Sugarcane	3	1.50	5	2.50
Maize	0	0.00	4	2.00
***Rabi* season**				
Wheat	40	20.00	192	96.00
Potato	6	3.00	13	6.50
Sunflower	0	0.00	1	0.50
Vegetables	7	3.50	19	9.50
Agroforestry				
Poplar	0	0.00	1	0.50

Comparative benefits of NCU over NU

The comparative benefits of NCU over NU can be seen from Table 12. It is quite obvious that only 5.29 percent of the sample farmers reported about the increase in paddy yield up to the extent of 2.40 percent due to application of NCU while 94.71 percent sample farmers revealed no change in the paddy yield. The cost of pest and disease control has declined by 21 per cent by

Table 10. Awareness and sources of information about Neem Coated Urea among the respondents in Punjab, 2015-16

(Percent of farmers)

Sources of Information	Marginal and Small	Medium	Large	Overall
Percent of farmers Aware	98.53	99.15	100.00	99.00
Sources of awareness				
Agricultural officer	-	-	-	-
Farmer facilitator	-	-	-	-
Fellow farmers	8.82	6.84	13.33	8.00
Print & visual media	-	0.85	-	0.50
Wall writing	-	-	-	-
KVK official	-	-	-	-
Agricultural university		0.85		0.50
Input shop	4.42	9.41	33.33	9.50
Company (suppliers)	-	-	-	-
Any other (Cooperative society)	85.29	81.20	53.34	80.50

application of NCU, as revealed by 13.76 percent respondents, while 86.24 percent realized no change in cost on pest control. All the respondents reported no change in weed management due to application of NCU. Cost of NCU application was higher as compared to urea, it was revealed by 89.42 percent farmers and extent of increase was six percent. On the contrary, 10.58 percent farmers reported about the decline in cost of NCU due to application of lower doses of NCU as compared to urea and extent of decline was 14 percent.

Constraints and suggestions about NCU and its adoption

Major problems faced in the adoption of NCU fertilizer have been shown in Table 13. A perusal of the Table 13 reveals that 1.50 percent farmers did not report any problem in adoption of NCU fertilizer. However, 94.71percent revealed high price of NCU fertilizer being major constraint in its adoption while 27 percent reported inadequate/ shortage of supply during peak season as another problem. Poor quality of NCU available in co-operative societies was another problem revealed by 8.50 percent farmers while 5.50 percent farmers were not aware about the uses and benefits of NCU. Another problem about NCU fertilizer application, reported by five percent farmers, was extremely pungent smell emanating during its broadcasting in the field.

Major suggestions for improving the NCU fertilizer usage have been given in Table 14. It can be seen that 27 percent farmers suggested assured/ timely and adequate supply of quality NCU during peak season to co-operative societies for improving the NCU fertilizer usage. Also, 7.50 percent farmers suggested about organizing training camps for spreading awareness regarding NCU uses/ benefits among the farming community. Other suggestions were regarding improving the quality of NCU (9.50 percent) and decreasing the price of NCU (74.50 percent) for increasing its usage. However, there was no response by 1.50 percent farmers when asked for giving suggestions for improving the NCU fertilizer usage.

Impact of Adoption of NCU on Crop Productivity and Farmers Income

Impact on crop productivity

Productivity of paddy (Table 15) due to application of NCU was 2845 kg per acre in 2014-15 while it increased to 2900 kg per acre in the year 2015-16. Also, there was

Table 12. Comparative benefits of NCU over normal urea in case of paddy in Punjab, 2015-16

(Percent of farmers)

Particulars	Increased	Decreased	No change	Extent of increase (percent)	Extent of decrease (percent)
Yield (q)	5.29	0.00	94.71	2.40	-
Cost of pest and disease control (₹)	0.00	13.76	86.24	-	21.00
Cost of NCU compared to normal urea (₹)	89.42	10.58	0.00	6.00	14.00

Table 13. Major problems faced in adoption of NCU fertilizer in Punjab, 2015-16

Problems	Percent of farmers
No problem	1.50
High prices	94.71
Inadequate/shortage of supply during peak season	27.00
Poor quality*	8.50
Not aware about the uses and its benefits	5.50
Problems in application (very pungent smell during application)	5.00

Powdery form (Manufacturing fault in a lot).
Percent exceeds 100 due to multiple response.

Table 14. Major suggestions for improving the NCU fertilizers usage in Punjab, 2015-16

Suggestions	Percent of farmers
Assured/timely and adequate supply of quality NCU during peak season	27.00
Training camps regarding awareness of NCU uses and benefits should be organized	7.50
Quality of NCU should be improved	9.50
Decreasing the price of NCU	74.50
No response	1.50

Percent exceeds 100 due to multiple response.

increase in productivity from 2786 kg per acre in 2014-15 to 2872 kg per acre in the year 2015-16 due to the application of NU. Hence, there was increase in productivity of paddy crop during 2015-16 where NCU, as well as NU, was applied on the sample farms. Although, the yield was higher on NCU farms as compared to NU farms during these years.

Fertilizer use efficiency

The comparative use of NCU versus normal urea (NU) in paddy crop has been shown in Table 15. A perusal of the table reveals that NCU quantity applied per acre was 95.50 kg per acre during the year 2014-15 while it increased to 116.50 kg per acre in 2015-16. There was increase in NCU usage by 21.99 percent in 2015-16 as compared to 2014-15 in case of paddy crop.

Similarly, the NU quantity applied declined from 40.48 kg per acre in 2014-15 to 14.38 kg per acre in 2015-16 and this decrease was to the extent of 64.48 percent. In aggregate there was decline in total urea (NCU+NU) by 3.75 percent. Thus, there was considerable increase in the application of NCU and decline in NU usage in paddy crop. Fertilizer use efficiency or output per unit of NCU was 29.79kg in 2014-15 and 24.89 in 2015-16. Decline in NCU fertilizer use efficiency was due to higher NCU usage despite increase in paddy productivity by 1.93 percent.

Table 15. Comparative use of NCU versus normal urea in paddy crop in Punjab, 2015-16

(Kg/acre)

Particulars	Year		
	2014-15	2015-16	Percent deviation
NCU quantity applied	95.50	116.50	21.99
NU quantity applied	40.48	14.38	-64.48
Total	135.98	130.88	-3.75
Productivity of NCU	2845	2900	1.93
Productivity of NU	2786	2872	3.09
Output per unit of NCU	29.79	24.89	-

Impact of NCU application on production and marketing of paddy

The impact of NCU on production and marketing of paddy has been given in Table 16. The impact in terms of increased main product yield was observed on the farms where exclusively NCU was applied to paddy crop. Paddy yield obtained was 29 quintals per acre for the farmers exclusively using NCU while it was 28.72 quintals per acre for NU and 28.53 quintals for the farmers who applied both NCU and NU to their paddy crop. Thus, paddy yield was just 0.97 percent higher on the farms exclusively using NCU as compared to NU. On the marketing front, there was no difference in the price received for the produce obtained while using NCU, NU or both since same minimum support price (MSP) of ₹1450 per quintal was received by the farmers. So, there was impact of NCU usage in terms of increased productivity of paddy and thereby increase in production also.

Impact on cost of cultivation of paddy crop

The impact of NCU on input cost of paddy can be observed in Table 17. A perusal of the Table 17 reveals that the cost of pest and disease control in paddy was ₹1518 per acre on the farms where NCU was exclusively used while it was ₹1755 per acre for NU and ₹1412 for the farms where both NCU and NU were used. Similarly, cost of weed management was ₹411 for exclusively NCU using farms, ₹435 for NU using and ₹403 for using both

Table 16. Impact of Neem coated urea (NCU) on production and marketing of paddy in Punjab, 2015-16

(q)

Particular	NCU (n_1=159)	Normal urea (n_2=11)	Percent deviation	Both (NCU and normal urea) (n_3=30)
Main product yield	29.00	28.72	0.97	28.53
Price of main product	1450	1450	-	1450

Table 17. Impact of Neem Coated Urea (NCU) on input cost of Paddy in Punjab, 2015-16

(₹/acre)

Particular	NCU (n_1=159)	Normal urea (n_2=11)	Percent deviation	Mean difference	t-statistic	Both (NCU and normal urea) (N=30)
Cost of pest and disease control	1518	1755	-13.50	237	2.350**	1412
Cost of weed management	411	435	-5.52	24	1.543 NS	403
Cost of urea	742	652	13.80	90	2.059**	514
Cost of other fertilizers	678	653	3.83	25	0.128 NS	464

***Significant at five percent level of probability.*
NS: Non-significant.

NCU and NU. Cost of NCU for the farms using it exclusively was ₹742 per acre which was higher than ₹652 for the farms using only NU while it was ₹514 for the farms using both NCU and NU for their paddy crop.

The cost of other fertilizers used was ₹678 on farms using NCU and ₹653 on farms using NU and ₹464 for the farms using both NCU and NU. Thus, there was decline in the cost of pest and disease control by 13.50 percent and weed management by 5.52 percent where NCU was exclusively applied to paddy crop as compared to NU but cost was least on the farms where NCU along with NU was applied. But only decrease in cost of pest and disease control and increase in cost of urea were found to be statistically significant. Although cost of NCU was more than NU but its impact was reflected in terms of lower cost of pest, disease control and weed management practices.

Economic feasibility of NCU using partial budgeting

The economic feasibility of NCU in paddy using partial budgeting framework has been given in Table 18. It can be seen from the Table 18 that there were numerous costs which were comparatively higher on the farms where exclusively NCU, as compared to NU, was applied by the farmers. These added costs were estimated at ₹326 per acre while there was also cost reduction on the farms where NCU was applied as compared to NU. The cost reduction was to the tune of ₹711 per acre. Thus, there was net cost reduction of ₹385 per acre. On the other hand, there were also higher gross returns on the farms using NCU as compared to NU. Added returns due to NCU amounted to ₹333. Therefore, there were added returns of ₹718 per acre by application of NCU on the sample farms and B:C ratio worked out to be 3.20.

Impact on soil health and crop growth

All the selected respondents were unanimous in giving their mind on the qualitative benefits of NCU on paddy growth in Punjab. It was revealed by all the respondents that there was neither improvement in the quality of paddy grain nor market acceptability due to better colour. Also, there was no change in the texture of the soil, soil moisture retention capacity, water infiltration rate, soil softness and decline in the compaction of the soil due to application of NCU as revealed by all the respondents. However, 13.76 percent farmers reported longer retention of nitrate in the soil and its slow release to the paddy crop (Table 19).

Table 19. Qualitative benefits in terms of soil health improvement in Punjab, 2015-16

Particulars	Percent farmers
Texture improved	-
Soil moisture retention increased	-
Improvement in water Infiltration	-
Improvement in soil softness	-
Compaction decreased	-
Others (Longer nitrate retention in soil)	**13.76**

Table 18. Economic feasibility of NCU in Paddy, using partial budgeting, Punjab, 2015-16

(₹/acre)

Added cost due to NCU	Costs (₹)	Reduced cost due to NCU	Costs (₹)
Ploughing Charges till planting	67	Cost of sowing/transplantation	86
Seed cost/ purchase of seedlings	18	Organic/Bio fertilizer/Manure/ City Compost/ Neem Cake	245
Neem Coated Urea	90	Irrigation Cost	87
Cost of other fetrilizers	25	Pesticides/Insecticides	236
Harvesting	18	Weedicide	24
Maintenance cost of tractor, thresher, pump set	106	Labour cost Owned	33
Labour cost Hired	2	-	-
Added cost	326	Reduced cost	711
Net cost reduction = ₹711- ₹326 = **₹385**			
Reduced return due to NCU	**Costs (₹)**	**Added returns due to NCU**	**Returns (₹)**
-	-	Gross returns	333
-	-	-	-
Total (A)	**326**	**Total (B)**	**1044**
B-A			**718**

Additional return from NCU is About ₹333 per acre.
An added return per acre is ₹718.
Benefit-Cost Ratio B:C Ratio= B/A=.3.20.

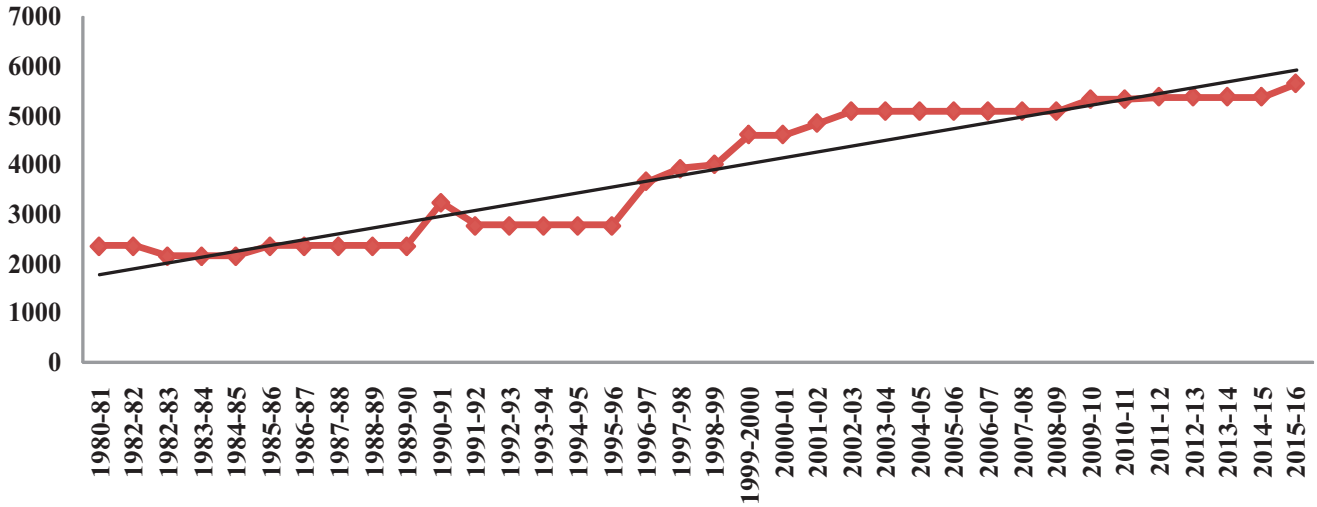


Figure. 1. Trend in price (₹) of urea, 1980-81 to 2015-16

CONCLUSIONS

The study brought to the following conclusions:

The district wise trends in consumption/ sale of urea in Punjab showed that during the year 2007-08 the consumption of urea was 2646.44 thousand MT which rose to 3086.05 thousand MT during the period 2007-08 to 2015-16 at an annual growth rate of 1.64 percent.

The urea prices increased significantly at the highest growth of 5.21 percent per annum during the decade 1990-91 to 1999-2000 while during the period 1980-81 to 2015-16 the growth in urea prices was 3.33 percent per annum.

Majority of the respondent farmers purchased NCU and NU from co-operative societies followed by private fertilizer dealers.

Total cost per bag of NCU, including transportation cost, worked out to be ₹289.69 while it was ₹276.58 per bag in case of NU.

There was marginal increase in the output/ productivity of paddy crop during the year 2015-16 as compared to the year 2014-15 which can't only be attributed to the application of NCU because there are numerous factors/ reasons significantly influencing the yield of a crop.

Gross returns from paddy crop worked out to be ₹41833 per acre during the year 2015-16 while it was ₹39740 in the year 2014-15. The corresponding figures for net returns were estimated to be ₹31401 during the year 2015-16 and ₹29530 in 2014-15 on the sample farms.

All the large farmers were aware about the NCU while 99.15 percent medium and 98.53 percent marginal and small farmers were also aware of it.

Major source of awareness regarding NCU was co-operative societies while input shop, fellow farmers, print and visual media and agricultural university were other sources of awareness.

As far as consumption of NCU is concerned, there was a significant increase in the application of NCU during 2015-16 in crops such as; paddy, wheat, basmati, sugarcane, potato, maize, sunflower,and vegetables.

Due to the application of NCU, only 5.29 percent farmers reported about the increase in paddy yield. Also, the cost of pest and disease control declined by 21 percent due to the application of NCU.

High price of NCU, inadequate/ shortage of supply during peak season and poor quality of NCU in some of the co-operative societies were the major problems reported by the respondents.

Major suggestions for increasing NCU usage were; assured/ timely and adequate supply of quality NCU during peak season to co-operative societies, organizing training camps for spreading awareness regarding NCU uses/ benefits among the farming community and decreasing the price of NCU for the benefit of the farmers.

There was increase in the productivity of paddy crop during the year 2015-16 as compared to 2014-15 where NCU was applied on the sample farms. Also, the NCU usage on the sample farms increased during this period while cost of pest/ disease control measures and weed management declined.

The partial budgeting framework brought out that there were added returns of ₹718 per acre by application of NCU on the sample farms.

There was neither improvement in the soil health nor change in the quality of paddy grain and its

market acceptability due to the application of NCU.

POLICY ISSUES

The above discussion brought out some policy issues which must be looked into to encourage the judicious use of NCU. Since now whole urea fertilizer produced in the country is neem coated, therefore, there would not be any problem with regard to its use at the farmers level. But the major point which should be taken care of is its good quality, adequate quantity, timely supply of NCU along with bringing its price at par with NU. Farmers should be educated about the balanced use of NCU along with other fertilizers for decreasing the cost of production of the crops.

REFERENCES

Agostini, F., Tei. F., Silgram, M., Farneselli, M., Benincasa, P., & Aller, F. (2010). Decreasing N leaching in vegetable crops through improvements in N fertilizer management, Genetic engineering, biofertilisation, soil quality and organic farming, ed Lichtfouse E. (Springer, Dordrecht, The Netherlands). *Sustainable Agriculture Reviews, 4*, 147–200.

Burns, I.G. (2006). Assessing N fertilizer requirements and the reliability of different recommendation systems. *Acta Horticulturae, 700*, 35–48.

Economic Advisor. (2014). *Statistical abstract of Punjab*. Chandigarh: Economics and Statistical Organization, Government of Punjab.

Neeteson, J.J., Booij, R., & Whitmore, A.P. (1999). A review on sustainable nitrogen management in intensive vegetable production systems. *Acta Horticulturae, 506*, 17-26.

Rahn, C. (2002). Management strategies to reduce nutrient losses from vegetables crops. *Acta Horticulturae, 571*, 19–25.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 13-17
DOI: 10.5958/2322-0430.2018.00028.8

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Acreage Response to Weather, Yield and Price of Groundnut and Sesamum Growers in Gujarat for Farmer's Sustainability

Ganga Devi[1], K.S. Jadav[2] and Ritambhara Singh[3]*

[1]*Assistant Professor, and* [2]*Professor and Head, Department of Agricultural Economics, B.A. College of Agriculture*
[3]*Assistant Professor, IABMI, Anand Agriculture University, Anand-388001 (Gujarat)*

[*]*Corresponding author's email: gangasaran1982@gmail.com*

Received: November 14, 2017 *Manuscript Number: NS-18-12* *Revision Accepted: February 28, 2018*

ABSTRACT
This study has analyzed the acreage response of groundnut and sesamum crop by using the Nerlovian partial adjustment model. The secondary data for the period 1985-86 to 2014-15 on area, production, yield, rainfall etc., for main crop and competitive crop was collected from various official sources. The competitive crop was selected on the basis of logically as well as statistically by calculating the correlation coefficient between crop areas. It has been observed that the sowing season rainfall is playing the significant role in deciding the area of both the crops by the farmers. On assessing acreage response positive and significant relationship of rainfall and negatively significant influence of MSP was observed on the groundnut acreage response. This may be due to the increase in the area of competitive crop and the availability of labor with the farmer at the time of harvesting. In case of sesamum crop, the lagged area and sowing season rainfall was having positive and significant influence on sesamum area and yield of cotton as a competitive crop was found negatively significant, implying that increase in the yield of competitive crop results into decrease the sesamum area.

Keywords
Acreage response, groundnut, Nerlovian model, price and non-price variables, sesamum.

JEL Codes
C24, C81, O13, Q12.

INTRODUCTION

Gujarat occupies an important place as supplier of groundnut, groundnut oil and groundnut cake to the rest of the country. Groundnut plays an important part in the agricultural and industrial economy of Gujarat state. Particularly in Saurashtra and Kutch region, groundnut crop has greater importance as it accounted for about 94.49 percent of the total groundnut area of the state. Groundnut crop is grown mainly as rainfed crop in the state. However, summer groundnut is also grown where the facility of assured irrigation is available. The estimated area and production of kharif groundnut was 13, 46, 900 hectares and 26, 31, 900 MT, respectively in the year 2014-15. Sesamum is also one of the important oilseed crop in Gujarat. It is mainly grown in Saurashtra region of state. Provisionally Gujarat produced about 1, 09,700 MT of sesamum from the area of 2, 03, 000 hectares during the year 2014-15.

The dynamics of each crops are different in each state. Yield acreage, farmers awareness cost structure, and government policies are also varied across the country.

Acreage response to price and non-price incentives is of considerable importance for devising suitable policy and planning development programmes for the agricultural sector of an economy. Agricultural pricing policy plays an important role in the farm decisions in the allocation of resources supply response is used as a tool to evaluate the effectiveness of price policies in the allocation of farmer's resource and estimates of supply responsiveness provides useful guidelines to the formulation of economic policy. Besides prices, there are various other non-price factors such as weather, rainfall, irrigation, technology *etc.* that also influence supply. The knowledge of supply response greatly helps in farm

decisions in the allocation of resources in the right direction. It can also help planners and policymakers to allocate and achieve productions targets in long-term planning (Gosalamang *et al*., 2012).

Minimum Support Price (MSP) is a form of market intervention by the Government of India to ensure agricultural producers against any sharp fall in farm prices. The minimum support prices are announced by the Government of India at the beginning of the sowing season for certain crops on the basis of the recommendations of the Commission for Agricultural Costs and Prices (CACP). MSP is price fixed by Government of India to protect the producer - farmers - against excessive fall in price during bumper production years. In the absence of such a guaranteed price, there is a concern that farmers may shift to other crops causing shortage in these commodities. As India is primarily agriculture based country, the need for timely and reliable information on types of crops grown with their acreages, crop yield, crop growth condition are of vital importance for tactical and strategic decision making by all stakeholder in agriculture. The output supply and factor demand are closely interlinked to each other. Therefore, any change in factor and product prices affects the factor demand and output supply simultaneously. The concept of supply response is dynamic and different from supply function which is the static concept. To formulate an effective price policy and food-security policy, one needs reliable empirical knowledge about the degree of responsiveness of input demand and crop output supply to input-output prices and technological changes. Supply response is fundamental to an understanding of this price mechanism (Nerlove & Bachman, 1960; Nerlove, 1958). Therefore this study was planned to estimate the acreage response of groundnut and sesamum crop by using price and non-price variables.

METHODOLOGY

To achieve the objectives of the study, the Time series data of groundnut and sesamum for last thirty years (1985-86 to 2014-15) on Area, Production, and Yield was obtained from various issues of Directorate of Agriculture, Agriculture and Cooperation Department, Government of Gujarat. Data regarding MSP and FHP was taken from Commission for Agricultural Cost and Prices (CACP) and from past reports of "Scheme for Creating a Permanent Machinery for Studying the Cost of Cultivation/Production of Principal Crops Grown in Gujarat State", respectively. Data on seasonal rainfall was taken from Indian Meteorological Department, Government of India. The data for acreage response of sesamum crop was considered for twenty years (1995-96 to 2014-15) because of availability of MSP the growth rate of MSP and FHP was also calculated for twenty years. The data pertaining to area, production and yield for all the crops for the year 2013-14 and 2014-15 was used provisional or estimated data. The data were compiled and analyzed using standard statistical tools such correlation between MSP and FHP by using Pearson Correlation Coefficient, compounds growth rates, instability index by coefficient of variation.

Acreage Response Model: The specification of model is as under:

Groundnut

logAt = logb0 + b1logPt-1 + b2logPct-1+ b3logYt-1+ b4logYct-1 + b5logAt-1 + b6logMMSPt + b7logCMSPt+b8logRFt+Ut

Sesamum

logAt = logb0 + b1logPt-1 + b2logPct-1 + b3logYt-1 + b4logYct-1 + b5logAt-1 + b6logMMSPt + b7logCMSPt + b8logRFt + Ut

The following finalized model for determining the acreage response to various factors that are lagged price, lagged area, lagged yield and average rain fall was estimated.

$$A_t = b_0 + b_1P_{t-1} + b_2P^c_{t-1} + b_3Y_{t-1} + b_4Y^c_{t-1} + b_5 M_{MSPt} + b_6 C_{MSPt} + b_7PR_t + b_8YR_t + b_9EP_t + b_{10}EY_t + b_{11}RF_t + b_{12}A_{t-1} + Ut$$

In the double log or log-linear form, this module would be as following:

$$\log A_t = \log b_0 + b_1\log P_{t-1} + b_2\log P^c t_{-1} + b_3\log Y_{t-1} + b_4\log Y^c_{t-1} + b_5\log M_{MSPt} + b_6\log C_{MSPt} + b_7\log PR_t + b_8\log YR_t + b_9\log EP_t + b_{10}\log EY_t + b_{11}\log RF_t + b_{12}\log A_{t-1} + Ut$$

Where;

A_t = Area of main crop in the current year (ha)

P_{t-1} = Farm harvest price of main crop lagged by one year (₹/q)

P^c_{t-1} = Farm harvest price of competing crop lagged by one year (₹/q)

Y_{t-1} = Yield of main crop lagged by one year (kg/ha)

Y^c_{t-1} = Yield of the competing crop lagged by one year (kg/ha)

M_{MSPt} = Minimum support price of main crop (₹/q)

C_{MSPt} = Minimum support price of competing crop (₹/q)

PR_t = Price risk variable

YR_t = Yield risk variable

EP_t = Expected price variable

EY_t = Expected yield variable

RF_t = Rainfall during sowing period in current year (mm)

A_{t-1} = Area of main crop lagged by one year (hectare)

U_t = a disturbance term.

Also, the independent variables were tested for their stochastic independence.

Estimation of Expected Yield and Price

Expected yield of crops was calculated as the average of the last three year's yield and expected price was calculated as the average of last three year's price of respective crop.

Estimation of Yield Risk and Price Risk

Risk due to yield and price was calculated as standard deviation of the last three year's yield and price, respectively, of the crop.

RESULTS AND DISCUSSION

Table 1 put forth that the compound growth rate of groundnut area (-0.20 percent) was negative and statistically non-significant, this may be due the increase in the area of cotton crop as a competitive crop of groundnut. Whereas the growth rate of production (5.19 percent) and productivity (5.40 percent) was found positive and highly significant. This implies that the production and yield of groundnut was significantly increased during last thirty years (1985-86 to 2014-15) but area was decreased. Further, the result shows that the instability index of area was low as compared to production and yield. This shows that the variability in production and yield was found more as compare to area.

It is also evident from the Table 1 that the compound growth rate of sesamum area (1.66 percent), production (5.37 percent) and productivity (3.65 percent) was found positive and highly significant. This implies that the sesamum area, production, and productivity has significantly increased over the years. However, the instability index of area was low as compared to production and yield. This showed that the variability in production and yield was more as compared to area.

Further, the results revealed that positive and highly significant growth rate was found of MSP (7.99 percent) and FHP (6.88 percent) of groundnut crop this showed that the MSP and FHP of groundnut has increased significantly over last thirty years. The results of instability index was also low for MSP and FHP this showed the less variability in prices. The correlation between Minimum Support Price and Farm Harvest Price of groundnut was also positive and highly significant (**0.** 957). That means if MSP increased the FHP was also increased or vice versa. Further, table showed that the positive and highly significant growth rate was found of MSP (9.48 percent) and FHP (9.15 percent) of sesamum crop this showed that the MSP and FHP of sesamum has risen significantly over last twenty years (1995-96 to 2014-15). The result of instability index was low for MSP as compared to FHP this showed the less variability in MSP of sesamum. Further, the results revealed that the correlation between Minimum Support Price and Farm Harvest Price was positive and highly significant (**0.** 963). That means both the prices are moved in same direction.

Acreage Response Model

Groundnut

The coefficients of the estimated model for groundnut along with the related statistics are presented in Table 2. The result shows that the regression coefficient of sowing season rainfall was found positive and highly significant. The estimated coefficient is 0.28, which suggests that an increase of 1 percent in the sowing season rainfall is expected to result in 0.28 percent expansion in groundnut acreage. Groundnut crop mainly grown in Saurashtra region of Gujarat in *kharif* season and this is the rain-fed area so farmers allocated the crop area on the basis of average seasonal rainfall. Mohammad *et al.* (2007) also reported that irrigation and rainfall appeared to be important non-price variables explaining wheat acreage. Whereas, the regression coefficient of MSP was found negative and significant at 10 percent level of probability which indicates that MSP increases results into decrease in the area of groundnut. This may be due to the increase in the area of competitive crop and the availability of labor with the farmer at the time of harvesting.

Table 3 shows short and long-run price and non-price elasticities. For groundnut acreage, short run and long run market price elasticity is worked out as 0.041 and 0.045, but not with any significant influence. Short and long-run elasticity of lag groundnut yield, lag area, lag price and lag yield of competitive crop was as per expected sign but statistically non-significant. In the case of rainfall, response variable (area) is inelastic to the independent variable (average rainfall) with significant influence. In the short run, a one percent increase in rainfall expands the total area by 0.286 percent and 0.312 percent in the long run. Average sowing season rainfall shows important effect on the decision of farmers regarding allocation of land to groundnut. This may be due to the fact that

Table 1. Compound growth rate and instability index of area, production, yield, FHP and MSP of groundnut and sesamum crop in Gujarat (1985-86 to 2014-15)

Crops	Compound growth rate (Percent)				
	Area	Production	Yield	FHP	MSP
Groundnut	-0.20	5.19***	5.40***	6.88***	7.99***
Sesamum	1.66**	5.37***	3.65***	9.15***	9.48***
		Instability Index (II)			
Groundnut	12.38	55.31	52.80	17.73	12.58
Sesamum	28.94	44.65	33.77	31.77	16.27
		Correlation between MSP and FHP			
Groundnut		0.957***			
Sesamum		0.963***			

******and ** Significant at 1 and 5 level.***

Table 2. Estimated coefficients of acreage response of groundnut (1985-86 to 2014-15)

Variables	Coefficients	Standard error	t-value	p-value
Intercept	3.277	0.850	3.851	0.000
Price of groundnut at time t-1	0.041	0.153	0.268	0.791
Price of cotton at time t-1	-0.115	0.147	-0.784	0.441
Yield of groundnut at time t-1	0.046	0.048	0.944	0.355
Yield of cotton at time t-1	-0.089	0.089	-1.004	0.326
Area of groundnut at time t-1	0.084	0.211	0.399	0.693
MSP of groundnut	-0.465	0.260	-1.788*	0.088
MSP of cotton	0.512	0.320	1.599	0.124
Sowing season rainfall	0.286	0.074	3.864***	0.000
R^2		0.533		
Adjusted R^2		0.354		

******and * significant at 1 and 10 level.***

groundnut is the rainfed crop in Gujarat state so farmers give more emphasis to sowing season rainfall for area allocation to the crop. The adjustment coefficient was very large (0.9165) indicated the more adjustment in the long run by the farmers.

Sesamum

The regression coefficients of the estimated model for sesamum crop along with the related statistics are presented in Table 4. The results put forth that the explanatory power of the estimated equation as reflected by R^2 of 0.83. The variables included in the function accounted for more than 80 percent of the variation in sesamum area during the period under reference. From the estimated equation it appears that the regression coefficient of lag yield of cotton, lag area of sesamum and sowing season rainfall was found statistically significant with their expected signs. The regression coefficient of lag yield of cotton was 0.28 percent. This indicated that the yield of competitive crop increased by one percent in previous year resulted into decrease the area of sesamum by 0.28 percent. The estimated coefficient of lagged sesamum area, of 0.48 is positive and significant which indicated that the 1 percent increase in the last year area of sesamum results into 0.48 percent increase in the sesamum area allocation by farmers in current years. The estimated coefficient of rainfall was also found positive and significant (0.42 percent).This seems that 1 percent increase in sowing season rainfall leads to 0.42 percent in acreage allocation. Sesamum is also a *kharif* crop so rainfall plays a significant role in acreage allocation by

Table 3. Estimates of short and long-run elasticities for groundnut (1985-86 to 2014-15)

Variables	Short run elasticities	Long run elasticities
Price of groundnut at time t-1	0.041	0.045
Price of cotton at time t-1	-0.115	-0.126
Yield of groundnut at time t-1	0.046	0.050
Yield of cotton at time t-1	-0.089	-0.097
Area of groundnut at time t-1	0.084	0.092
MSP of groundnut	-0.465	-0.508
MSP of cotton	0.512	0.559
Sowing season rainfall	0.286	0.312
Adjustment coefficient	0.916	

Table 4. Estimated coefficients of acreage response of sesamum (1995-96 to 2014-15)

Variables	Coefficients	Standard error	t-value	p-value
Intercept	2.723	2.393	1.138	0.279
Price of sesamun at time t-1	0.150	0.221	0.679	0.511
Price of cotton at time t-1	-0.260	0.290	-0.897	0.389
Yield of sesamum at time t-1	0.146	0.165	0.883	0.396
Yield of cotton at time t-1	-0.281	0.114	-2.473**	0.031
Area of sesamum at time t-1	0.485	0.188	2.588**	0.025
MSP of sesamum	0.308	0.933	0.331	0.747
MSP of cotton	-0.695	1.563	-0.444	0.665
Sowing season rainfall	0.424	0.138	3.065***	0.011
R^2		0.829		
Adjusted R^2		0.706		

******and ** significant at 1 and 5 level.***

Table 5. Estimates of short-run and long-run elasticities for Sesamum (1995-96 to 2014-15)

Variables	Short run elasticities	Long run elasticities
Price of sesamum at time t-1	0.150	0.291
Price of cotton at time t-1	-0.260	-0.505
Yield of sesamum at time t-1	0.146	0.283
Yield of cotton at time t-1	-0.281	-0.546
Area of sesamum at time t-1	0.485	0.942
MSP of sesamum	0.308	0.598
MSP of cotton	-0.695	-1.350
Sowing season rainfall	0.424	0.823
Adjustment coefficient	0.515	

the farmers. Whereas, Saddiq *et al.* (2014) reported that rainfall showed insignificant effect on farmer's decision regarding area allocation to sugarcane crop.

The short run (0.150) and long-run (0.291) elastcities for sesamum price was quite satisfactory (Table 5) but statistically non-significant. The short and long-run elasticities with significant influence was found for lag area of sesamum lag yield of competitive crop and sowing season rainfall. This implied that the last year area allocation of crop, last year yield of competitive crop and rainfall play the significant role in area allocation to sesamum crop by the farmer. The long-run elasticity of MSP of cotton as a competitive crop was found perfectly elastic (-1.350) but with the non-significant influence. The adjustment coefficient was quite large (0.515) that shows the more adjustment in the long run by the farmers.

CONCLUSIONS

It was concluded based on findings of the study that MSP and FHP for both the crops were significantly correlated in positive direction and compound growth rate of MSP and FHP were also found positive and highly significant. In case of area, the positive and significant growth rate was found for Sesamum and negatively non-significant growth rate was found for Groundnut. However, the compound growth rate of production and yield was positive and significant for both the crops. On assessing acreage response positive and significant relationship of rainfall and negatively significant influence of MSP was observed on the groundnut acreage response. This may be due to the increase in the area of competitive crop and the availability of labor with the farmer at the time of harvesting. In case of sesamum crop, the lagged area and sowing season rainfall was having positive and significant influence on sesamum area and yield of cotton as a competitive crop was found negatively significant, implying that increase in the yield of competitive crop results into decrease the sesamum area. It is worthwhile to mention that farmers' experience about the obtaining sowing season rainfall plays a crucial role in determining its profitability and hence incentives for its further cultivation and expansion of area under the crops.

REFERENCES

Gosalamang, D.S., Belete, A., Hlongwane, J.J., & Masuku, M. (2012). Supply response of beef farmers in Botswana: A Nerlovian partial adjustment model approach. *African Journal of Agricultural Research, 7*(31), 4383-4389.

Mohammad, S., Javed, M.S., Ahmad, B., & Mushtaq, K. (2007). Price and non-price factors affecting acreage response of wheat in different agro-ecological zones in Punjab: A co-integration analysis. *Pakistan Journal of Agricultural Sciences, 44*(2), 370-377.

Nerlove, M. (1958). *The dynamics of supply: Estimation of farmers' response to price*. Baltimore, Maryland, United States: John Hopkins University Press.

Nerlove, M., & Bachman, K.L. (1960). The analysis of changes in agricultural supply: Problems and approaches. *Journal of Farm Economic, 42*, 531-554.

Saddiq, M., Fayaz, M., Hussain, Z., Shahab, M., & Ullah, I. (2014). Acreage response of sugarcane to price and non-price factors in Khyber Pakhtunkhwa. *International Journal of Food and Agricultural Economics*, *2*(3), 121-128.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 18-22
DOI: 10.5958/2322-0430.2018.00029.X

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Assessing Climate Change Impacts and Vulnerability Indices in Regions of Eastern Uttar Pradesh

Harshika Choudhary[1], and P.S. Badal[2]*

[1]Research Scholar and [2]Professor and Head
Department of Agricultural Economics, Institute of Agricultural Economics, BHU, Varanasi-221005 (UP)

[*]Corresponding author's email: chaudharyharshika@gmail.com

Received: January 12, 2018 *Manuscript Number: NS-18-16* *Revision Accepted: March 19, 2018*

ABSTRACT
In this study, climate change impacts are examined from agricultural and climatic characteristics. The analysis is carried out on the district level for the period of 30 years (1982-2012). The vulnerability is assessed by the frequency of extreme events. The study aims to build a vulnerability index and rank the districts based on their performance. The impact of the floods creates a vicious cycle of poverty and livelihood. From the data, it was clear that Gorakhpur, Siddharth Nagar, and Maharajganj were highly climatic vulnerable than other districts. The agricultural vulnerability index was highest in Bhadohi, Basti and Sant KabirNagar districts accounted due to least food grains production, livestock population and due to other agricultural attributes mentioned in the indicator. Rising temperatures, increasingly erratic rainfall, and more frequent and severe floods and droughts all have significant consequences for the livelihood security of people.Azamgarh, Chandauli, and Jaunpur were reported the least agricultural vulnerable districts.

Keywords
Climate change, Eastern Uttar Pradesh, Narayan and Patnaik index, Vulnerability indices.

JEL Codes
Q54, Q56, Q57.

INTRODUCTION

The ordinary use of the word 'vulnerability' refers to the capacity to be wounded, i.e. the degree to which a system is likely to experience harm due to exposure to a hazard. The scientific use of 'vulnerability' has its roots in geography and natural hazards research but this term is now a central concept in a variety of research contexts such as natural hazards and disaster management, ecology, public health, poverty and development, secure livelihoods and famine, sustainability science, land change, and climate impacts and adaptation.

From a climate change perspective, according to the IPCC, Vulnerability is defined as the extent to which a natural or social system is susceptible to sustaining damage from climate change. The vulnerability is a function of the sensitivity of a system to changes in climate and the ability to adapt to the system to changes in climate. Under this framework, a highly vulnerable system would be one that is highly sensitive to modest changes in climate. (IPCC TAR, 2001)

The three components of vulnerability, according to the IPCC definition are:

Exposure,
Sensitivity,
Adaptive capacity.

The vulnerability is the degree to which a person, system or unit is likely to experience harm due to exposure to perturbations or stresses (Kasperson *et al*., 2003)

Vulnerability assessment identifies who and what is exposed and sensitive to change. A vulnerability assessment starts by considering the factors that make people or the environment susceptible to harm, that is, access to natural and financial resources; ability to self-protect; support networks and so on. (Tompkins *et al.*, 2005)

Vulnerability: Refers to the magnitude of harm that would result from a particular hazardous event. The

concept recognizes, for example, that different sub-types of a receptor may differ in their sensitivity to a particular level of hazard. Therefore climate vulnerability defines the extent to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. It depends not only on a system's sensitivity but also on its adaptive capacity. Hence arctic-alpine flora or the elderly may be more vulnerable to climate change than other components of our flora or population. (UKCIP, 2004)

India is facing a challenge of maintaining its place in economic growth along with tackling the problem of Climate change. The climate change is adversely affecting the livelihood and lifestyle of people of India.

The fourth assessment report of IPCC-AR4 concluded from direct observations of changes in temperature, sea level and snow cover in the northern hemisphere during 1850 to present, that the warming of earth's climate system is unequivocal. The global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 ppm to 379 ppm in 2005. Multi-model averages show that the temperature increases during 2090-2099 relative to 1980-1999 may range from 1.1 to 6.4 °C and sea level rise from 0.18 to 0.59 meters. These could lead to impacts on freshwater availability, oceanic acidification, food production, flooding of coastal areas, and increased burden of waterborne and vector-borne diseases associated with extreme weather events.

Counteracting vulnerability requires:

reducing the impact of the hazard itself where possible (through mitigation, prediction, and warning, preparedness);

building capacities to withstand and cope with hazards; and

tackling the root causes of vulnerability, such as poverty, poor governance, discrimination, inequality and inadequate access to resources and livelihoods.

METHODOLOGY

The study was conducted in eastern part of Uttar Pradesh state in India. The data for the present study was collected from secondary sources related to climatic variables, crop yield, etc. As such the data were collected from various publications of Food and Agricultural Organization (FAO), The Intergovernmental Panel on Climate Change (IPCC) Government agencies and other websites. To examine the agricultural vulnerability to climate change, climate vulnerability index was constructed using Patnaik and Narain method. The sources and indicators of vulnerability identified and their functional relational relationship is identified and tabulated in Table 1.

Normalization of Indicators Using Functional Relationship

For each component of vulnerability, the collected data was arranged in the form of a rectangular matrix with rows representing regions and columns representing indicators. The indicators were in different units and scales. The methodology used in UNDP's Human

Table 1. Indicators and sub-indicators of vulnerability

Indicators	Sub-indicators
Demographic vulnerability	i. Density of population (persons per square kilometer) ii. Literacy rate (percentage) iii. Infant mortality rate (deaths per '000 infants)
Climate vulnerability	i. Annual rainfall (mm) ii. Southwest monsoon (mm) iii. Northeast monsoon (mm) iv. Maximum temperature (^{o}C) v. Minimum temperature (^{o}C)
Agricultural vulnerability	i. Production of food grains (tonnes/hectare) ii. Productivity of major crops (tonnes/ hectare) iii. Cropping intensity (percentage) iv. Irrigation intensity (percentage) v. Livestock population (Number per hectare of net sown area) vi. Forest area(percentage geographic area)
Occupational vulnerability	i. The number of cultivators ii. Total main workers iii. Agricultural laborers iv. Marginal workers v. Industrial workers vi. Non-workers
Geographic vulnerability	i. Forest (km) ii. Geographical area (ha)

Development Index (HDI) (UNDP, 2006) was followed to normalize them. That is, in order to obtain figures which are free from the units and also to standardize their values, first they were normalized so that they all lie between 0 and 1. Before doing this, it is important to identify the functional relationship between the indicators and vulnerability (Table 2). Two types of functional relationship are possible: vulnerability increases with an increase (decrease) in the value of the indicator. Assume that higher the value of the indicator more is the vulnerability. For the variables having positive functional relationship with vulnerability, the normalization will be done using the formula

xij= Xij – Min (Xij)/ Maxi(Xij) – Mini(Xij)

Here xij is the index for the indicator j corresponding to the region I all these scores will lie between 0 and 1. The value 1 will correspond to that region with maximum value and 0 will correspond to the region with the minimum value.

For the variable having negative functional relationship with vulnerability, the normalization will be done using the formula

Yij= Max(Xij)-Xij/ Maxi (Xij) – Mini (Xij)

After normalization, the average index (AI) for each source of vulnerability will be worked out and then the overall vulnerability index is computed by employing the following formula:

$$VI \quad \frac{\overset{n}{\underset{i\ 1}{}}(AL)^{\frac{1}{}}}{n}$$

Where AI = average index, *n* is the number of sources of vulnerability and α = n

To analyze the vulnerability in the region, the two components were selected from the Narayan and Patnaik method i.e. Agricultural and Climatic vulnerability.

Table 2. Functional relationship of indicators

Components	Indicators	Functional relationship
Climatic vulnerability	Annual rainfall	↑
	South-west monsoon	↑
	North-east monsoon	↑
	Maximum temperature	↑
	Minimum temperature	↑
Agricultural vulnerability	Production of food grains	↓
	Productivity of major crops	↓
	Cropping intensity	↓
	Irrigation intensity	↓
	Livestock population	↓
	Forest area	↓

RESULTS AND DISCUSSION

In order to ensure that people's vulnerability to climate change, we must understand who is vulnerable to the effects of climate change more and by how much?The Vulnerability analysis helps us to understand the implications of climate change for the lives and livelihoods of the people.

Climatic Vulnerability: Scenarios generated by global circulation models show that India could experience warmer and wetter conditions as a result of climate change, particularly if the summer monsoon becomes more intense (Mitra *et al*., 2002; Kumar & Parikh, 2001; McLean *et al.,* 1998). However, increased rates of evapotranspiration due to the higher temperatures may offset the increased precipitation, leading to negative impacts on soil moisture (Kumar & Parikh, 2001). Glantz & Wigley (1986) studied the worldwide climate change and showed that any change in climatic variables like temperature and precipitation could induce vulnerability of food production in a major way.

Agricultural Vulnerability: Among India's population of more than one billion people, about 68 percent are directly or indirectly involved in the agricultural sector. This sector is particularly vulnerable to present-day climate variability, including multiple years of low and erratic rainfall. Birthal *et al.* (2014) studied that the projections of climate impacts towards 2100 have suggested that with significant changes in temperature and rainfall, the rice yield will be lower by 15 percent and wheat yield by 22 percent. Coarse cereals will be affected less, while pulses will be affected more than cereals.

Comparative Analysis of Indicators of Selected Districts of Eastern Uttar Pradesh

Climatic vulnerability: The computation of data related to annual rainfall (mm), south-west monsoon (mm), north-east monsoon (mm), maximum temperature (°C), minimum temperature (°C) had been done to find out the vulnerability indices for each district. The index with the ranks has been given in Table 3.

Under theclimatic factors, Gorakhpur ranked first in vulnerability index (0.683) followed by Siddharthnagar (0.662) and Maharajgunj (0.651). The highest vulnerability in the stated districts may be accompanied due to highest rainfall in Siddharthnagar (1412.3mm), Gorakhpur (1364.1mm) and Maharajgunj (1364.1mm). The data pertaining to S-W and N-E monsoon was also reported highest among other districts. The maximum temperature in the most vulnerable districts was also recorded, a notch above normal, though maximum and minimum mean temperature were reported alike in all districts due to the nearby geographical occurrence. The least climatic vulnerable districts were Pratapgarh, Bhadohi, and Sonbhadra with least indices.

The climate change and its potential impact on agriculture were also reported in previous studies. Seshu & Cady (1984) have estimated a decrease in rice yield at the rate of 0.71 t/ha with an increase in minimum

Table 3. Vulnerability indices of different districts along with the ranks

Districts	Climatic vulnerability		Agricultural vulnerability	
	Index	Rank	Index	Rank
Pratapgarh	0.283332	18	0.457601	13
Siddarth Nagar	0.662226	2	0.511413	6
Maharajganj	0.651563	3	0.473528	12
Basti	0.387358	15	0.713418	2
Gorakhpur	0.683241	1	0.420521	14
Deoria	0.543664	7	0.49415	9
Mau	0.588327	4	0.49882	7
Azamgarh	0.571556	6	0.266532	18
Jaunpur	0.579753	5	0.351498	16
Ballia	0.508063	8	0.494659	8
Ghazipur	0.433888	14	0.38913	15
Varanasi	0.478788	11	0.574382	4
Mirzapur	0.502625	9	0.487468	10
Sonebhadra	0.382441	16	0.481464	11
Bhadohi	0.298491	17	0.753092	1
Kushinagar	0.489998	10	0.536621	5
Chandauli	0.450151	13	0.346234	17
Sant Kabir Nagar	0.464862	12	0.683923	3

temperature from 18°C to 19°C and a decrease of 0.41 ton/ha with a temperature increase from 22°C to 23°C. Sinha & Swaminathan (1991) show that a 2° C increase in mean air temperature could decrease rice yield by about 0.75 ton/hectare in the high yield areas and by about 0.06 ton/hectare.

Agricultural vulnerability: On the account of agricultural vulnerability production of food grains was maximum in Azamgarh (912011 mtonnes) and least was found in Bhadohi (152961 m tonnes). The productivity of food grains was highest in Gorakhpur district followed by Mau. Cropping intensity was highest in Maharajgunj (182.97 percent). Livestock population, also a component of agricultural vulnerability was highest in Azamgarh district (2461397) and least in Santkabir Nagar. Sonbhadra reportedly acquires highest forest area compared to other districts. Irrigation intensity was highest in Mau (97.07 percent).

However only relates to these parameters with mean data of censuses in not enough to compare the vulnerability. Therefore, to analyze the data of associated factors over the different period of time all the data of different parameters arranged accordingly and indices were computed after normalization. Taking into consideration all these variables, Bhadohi was the most agricultural vulnerable district with index 0.753 followed by Basti (0.713) and Sant Kabir Nagar (0.683) respectively. Azamgarh, Jaunpur, and Chandauli were ranked as the least vulnerable districts.

The other studies showed that in certain areas, including Maharajganj, Gorakhpur the waterlogged area increased by 65-95 percent during 1971 to 1991. In many cases, waterways developed across the road and railway embankments, drain water away insufficiently. Excessive rainfall can cause overflowing of low and poorly formed riverbanks, and drainage congestion is a serious problem. Siphons are either closed during high floods or do not function due to silting and clogging. The flood hazard is pronounced where drainage channels merge into the Rohini, especially lower in the basin above the confluence of the Rohini and Rapti Rivers. The overall nature of flooding, therefore, has changed; inundation depths have become higher and more unpredictable (embankment failures), with constant water logging in certain areas. While earlier floods were considered to have done more good than harm, they now cause immense damage to life and property and have become an obstacle to development in the region.

CONCLUSIONS

Climate change presents additional obstacles to ending poverty and achieving social justice. Rising temperatures, increasingly erratic rainfall, and more frequent and severe floods, cyclones and droughts all have significant consequences for the livelihood security of poor people; and development professionals are seeing first-hand the effects of a changing climate on their work around the world. By combining local knowledge with scientific data, the process builds people's understanding of climate risks and adaptation strategies. It provides a

framework for dialogue within communities, as well as between communities and other stakeholders. The results provide a solid foundation for the identification of practical strategies to facilitate community-based adaptation to climate change.

Like all of eastern India, the Rohini and Rapti Basins are prone to floods during the four monsoon months. About one-third of Rohin's catchment lies in the Nepal Tarai where cloudbursts cause intense rainfall events. There is always some annual flooding, with major floods have occurred in 1954, 1961, 1974 and 1993. In the last 10 years, the intensity and frequency of floods appear to have increased and three major floods have occurred within a decade: 1998, 2001 and 2007.

The recurrence period of highly deficient rainfall in East U.P. has been calculated to be 6 to 8 years whereas in West U.P. it is 10 years. The annual loss due to drought in the State varies depending on the severity of the drought. In the recent years, the year 2002, & 2004 were severe in terms of drought, with the loss to crop, livestock and property assessed at ₹7540 crores and ₹7292 crores respectively.

REFERENCES

Birthal, P., Khan, T., Negi, D., & Agarwal, S. (2014). Impact of climate change on yields of major food crops in India: Implications for food security. *Agricultural Economics Research Review, 27*(2), 145-155.

Glantz, M.H., & Wigley, T.M.L. (1986). Climatic variations and their effects on water resources (pp. 625-641). In D.J. McLaren & B.J. Skinner (Eds.) *Resources and world development*. Dahlem Konferenzen: John Wiley and Sons, S. Bernhard.

IPCC TAR. (2001). *Climate change 2001: Impacts, adaptation, and vulnerability*. IPCC Third Assessment Report, Cambridge University Press.

Kasperson, J.X., Kasperson, R.E., Turner II, B.L., Schiller, A., & Hsieh, W.H. (2003). Vulnerability to global environmental change. In A. Diekmann, T. Dietz, C, Jaeger, C., & E.S. Rosa (Eds.), *The Human dimensions of global environmental change*. MIT, Cambridge, Massachusetts Institute of Technology.

Kumar, K.S.K., & Parikh, J. (2001). Indian agriculture and climate sensitivity. *Global Environmental Change, 11*, 147-154.

McLean, R.F, Sinha, S.K, Mirza, M.Q., & Lal, M. (1998). *Tropical Asia. The regional impacts of climate change: An assessment of vulnerability,* Intergovernmental Panel on Climate Change by Cambridge University Press, Cambridge.

Mitra A.P., Kumar, D., Rupa, M., Kumar, K., Abrol, Y.P., Kalra, N., & Velayutham, M. (2002). Global change and biogeochemical cycles: The South Asia region. In P. Tyson, R. Fuchs, C. Fu, L. Lebel, A. P. Mitra, E. Odada.....H. Virji (Eds.). *Global-regional linkages in the earth system*. Berlin: Springer Verlag, Pp. 75-107.

Seshu, D.V., & Cady, F.B. (1984). Response of rice to solar radiation and temperature estimated from international yield trials. *Crop Science, 24*, 649-654.

Sinha, S.K., & Swaminathan, M.S. (1991). Deforestation, climate change and sustainable nutrition security: A case study of India. *Climatic Change, 19*, 201-209.

Tompkins, E.L., Nicholson-Cole, S.A., Hurlston, L., Boyd, E., Brooks Hodge, G., Clarke, J.....Varlack, L. (2005). *Surviving climate change in small islands: A guidebook*. Tyndall Center for Climate Change Research, UK.

UKCIP. (2004).*Costing the impacts of climate change in the UK*. Oxford, UK: University of Oxford. Retrieved from http://www.sfrpc.com/Climatepercent20Change/7.pdf.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 23-26
DOI: 10.5958/2322-0430.2018.00030.6

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Growth of Sugarcane in Maharashtra and Total Factor Productivity Analysis

D.J. Sanap, R.B. Hile, and D.B. Yadav*

Department of Agricultural Economics, Mahatma Phule Krushi Vidyapeeth
Rahuri-413722 District Ahmednagar (Maharashtra)

**Corresponding author's email: sanapdj@gmail.com*

Received: December 03, 2017 *Manuscript Number: NS-18-18* *Revision Accepted: January 20, 2018*

ABSTRACT

Measurement of productivity growth is very essential to take appropriate policy decisions for the development of the agriculture sector. The present study measures Growth of Sugarcane in Maharashtra with total factor Productivity analysis. Tornquist-Theil Index method is used for this study. The results indicated that increase in production of sugarcane crop is because of increased area and productivity of sugarcane crop in Maharashtra. There is a growth in output index of sugarcane crop by 3.70 percent and in input index, it was found to be 1.09 percent hence the total factor productivity of sugarcane crop in Maharashtra state increases by of 2.59 percent, with 70 percent TFP share in output. Area under high yielding varieties, Rainfall and road density had positive and significant impact on total factor productivity growth of sugarcane crop in Maharashtra.

Keywords
Productivity, sugarcane, Tornquist-Theil Index, total factor productivity.

JEL Codes
C43, C81, D24, O44, Q12, Q18.

INTRODUCTION

India is the second largest producer of sugar in the world after Brazil and is indulged in the production of cane sugar and not beet sugar. It produces approximately 22 million tonnes of sugar annually. The major sugarcane growing states in India are Uttar Pradesh, Maharashtra, Tamil Nadu, Andhra Pradesh, Karnataka, and Gujarat. These states contribute around 85 percent sugarcane production of the country. The other important producers of sugarcane in the country are Assam, Bihar, Haryana, Kerala, Madhya Pradesh, Orissa, Punjab, Rajasthan and West Bengal. The production of sugar in the country highly depends upon the availability of sugarcane. The leading producer of sugar is Maharashtra producing about 6 million tonnes of sugar followed by Uttar Pradesh and Karnataka and these states constitute the maximum area under sugarcane in the country. The production of sugarcane in India has increased during the last ten years and is still on an increasing trend. The productivity of sugarcane in the northern areas of the country was lower than the productivity in southern areas. In India, sugarcane is grown over 4 million hectares of land.

The analytical inadequacies of the Single Factor Productivity (SFP) measures led economist to evolve the TFP measures, the TFP index is composite measure of productivity, which relates output to all inputs simultaneously, and the change in TFP index can be used as one measure of technological change. Earlier Laspeyres arithmetic indices were used most commonly to measure TFP (Pandya & Shiyani, 2002). But most recent literature of TFP (Kumar & Mruthyunjay, 1992; Kumar & Rosegrant, 1994) has advocated and employed Tornqvist - Theil or translog index in their study because of its superiority. TFP trend indicates whether production growth is taking place in a cost-effective and sustainable manner or not.

TFP is influenced by changes in technology, institutional reform, infrastructure development, human resource development, investment in research and development, level of technology adoption and other factors. Recent experience shows a slowdown in productivity growth of various crops or even some

setbacks indicating that all is not well. This has given rise to some pertinent questions namely what is the direction of productivity? Are inputs efficiently utilized? What is the growth in inputs and outputs? This needs elaboration from the TFP studies. Empirical studies of the TFP on developing countries in agriculture are becoming increasingly important in providing a complex picture of technological change. The TFP for Indian crop sector was measured by Rosegrant & Evenson (1992), but the results of the sectorial approach cannot be used precisely for policy decisions with respect to individual crops because technological change varies across crops. Thus TFP growth has to be examined for individual crops (Kumar & Rosegrant, 1994). Hence, the main focus of study was to measure the growth in total factor productivity of sugarcane of Maharashtra and its determinants.

OBJECTIVES AND METHODOLOGY

The main objective of the paper is to analyze the growth of sugarcane crop in Maharashtra. Farm-level data on yield, level of input use and their prices for the period 2003-04 to 2014-15 were collected from the "Scheme for the study of cost of cultivation of principal crops" Government of Maharashtra, This dataset provided a rich source for measuring and analyzing the agricultural productivity. The time series data on infrastructural variables (road density, number of village electrified, number of pump sets, number of tractors), cropping intensity, total loan amount disbursed, annual rainfall, area under irrigation, area under high yielding variety, land-use pattern etc were collected from various publications of government of Maharashtra.

Compound Growth Rate

The growth rate of area, production, productivity, input and output of major crops were estimated by using semi-log trend equation.

$Y = ab^t$

Compound growth rate = (b – 1) x 100

Analysis of Total Factor Productivity (TFP)

Total Factor Productivity (TFP) sometimes referred as multifactor productivity, is a true measure of economic efficiency. TFP measures the extent of increase in output, which is not accounted by increase in total inputs. There are three main approaches for estimating the TFP, namely the production function approach (PFA), growth accounting approach (GAA) and non-parametric approach. The Production Function Approach (PFA) is associated with various problems like multicollinearity, autocorrelation, and degree of freedom, whereas non-parametric approach like Data Envelope analysis is very sophisticated and uses linear programming methodology. In Growth Accounting Approach (GAA), TFP is measured as a residual factor, which attributes to that part of growth in the output that is not accounted for by the growth in the basic factor inputs. Amongst three approaches, growth accounting approach is popular mainly because it is easy to implement, requiring no econometric estimation.

The use of TFP indices gained prominence since Diewert (1976; 1978) proved that the Theil-Tornqvist discrete approximation to the Divisia index is consistent in aggregation and superlative for a linear homogeneous translogarithmic production function. In the present study, Divisia-Tornqvist index has been used for computing the total output, total input and TFP for specified year "t" by for selected crops.

Total output index (TOI)

$TOI_t / TOI_{t-1} = \pi_j (Q_{jt}/Q_{jt-1})^{(R_{jt} + R_{jt-1})1/2}$ …[1]

Total input index (TII)

$TII_t / TII_{t-1} = \pi_j (X_{it}/X_{it-1})^{(S_{it} + S_{it-1})1/2}$ …[2]Where,

R_{jt} is share of the jth output in total revenue

Q_{jt} is Output of the jth commodity

S_{it} is share of the ith input in total input cost

X_{it} is quantity of the ith input

t is the time period

For productivity measurement over a long period of time, chaining indexes for successive time period is preferable. With chain liking,an index was calculated for two successive periods t and t-1 over the whole period 0 to T (samples from time t = 0 to t = T) and the separate index wasthen multiplied together.

TOI (t) = TOI (1). TOI (2)…… TOI (t-1)… [3]

TII (t) = TII (1) .TII (2)…….. TII (t-1)… [4]

Total factor productivity index (TFP) is given by equation [5]

$TFP_t = (TOI_t / TII_t)$ …[5]

Chain-linking index takes into account the changes in relative values/costs throughout the period of study. This procedure has the advantage that no single period plays a dominant role in determining the share weights and biases are likely to be reduced. For constructing the total input index, ten important inputsviz. human labour, bullock labour, machine labour, farmyard manure (FYM), nitrogen, phosphate and potash fertilizers, irrigation, plant protection and land were included.

Factors Influencing TFP

To know the influence of infrastructural, socio-economic and technological variable on the productivity of major crops a multivariable model in the form of log-linear was estimated as follows. The time series data from the year 2003-04 to 2014-15 were considered for the present study.

$LnY = Ln\,a + b_1 \ln X_1 + b_2 \ln X_2 + \ldots\ldots\ldots\ldots + b_n \ln X_n$ Where,

Y = TFP

b_i = Elasticities

X_1 = Total amount of loan (short term + medium term + long term loans) sanctioned by commercial banks, regional rural banks, cooperative banks, primary agricultural cooperative societies and land development banks per thousand hector of net cultivated area (₹lakhs).

X_2 = Proportion of double sown area.

X_3 = Proportion of net cropped area under irrigation.

X_4 = Proportion of net cropped area under high

yielding varieties.

X_5 = Annual rainfall (mm)

X_6 = Number of villages electrified per 000' ha of net cultivated area

X_7 = Number of tractors per 000' ha of net cultivated area.

X_8 = Number of pump sets per 000' ha area of net cultivated area

X_9 = Road density kilometer per 000'ha of net cultivated area.

In all, there were nine factors studied, the stepwise regression analysis which gave only more significant variables in the model was run.

RESULTS AND DISCUSSION

Performance of Sugarcane Crop in Maharashtra

It can be seen from Table 1 that the production of sugarcane in Maharashtra has been increased significantly with the growth rate of 10.07 percent. Area of sugarcane also shows increasing trend in Maharashtra by 8.17 percent and productivity of sugarcane also shows increasing trend by 1.76 percent. Increases in production of sugarcane crop in Maharashtra is both because of increase in area and productivity.

Input Share

Share of input in cost of cultivation showed the importance of that input in total cost structure. Table 2 depicts input share in cost structure of sugarcane in Maharashtra. Rental value of land was having major share (21.16) in cost of cultivation of sugarcane in all the time span of research. Energy component was second important input in cost structure of sugarcane. Farmers were adopted conservative agricultural production technologies to cultivate sugarcane crop which were not suitable for using modern inputs and mechanization; hence farmers utilized more energy in the form of male labour, female labour, and bullock labour.

The output of sugarcane fetches comparatively more prices; hence sugarcane sets required for planting were also costlier. Irrigation cost (5.92 percent) was important in sugarcane cultivation. Nutrients especially nitrogen, phosphorous and potash are required in different quantum hence differences have been observed in nutrient cost.

Total Factor Productivity

Sustainable growth in agriculture led to development, which in turn was critically dependent upon the productivity growth, technological change, and economics of scale and efficiency of factor used. The productivity behaviors were examined and the results were presented in Table 3 and 4. The highest total factor productivity was observed in the year 2014-15 (146.78 percent) and the lowest total factor productivity (80.88 percent) was in the year 2005-06. The climatic conditions of agriculture year 2005-06 were unfavorable for sugarcane cultivation. Sugarcane output index was more than input index hence the TFP growth was positive in sugarcane crop. The growth in input index was positive

Table 1. Growth and instability in sugarcane in Maharashtra (2003-04 to 2014-15)

Parameter	Area	Production	Productivity
Mean	8.312308	683.1554	81.53846
CGR	8.17 **	10.07 ***	1.76 ***
R^2	0.508 **	0.579 ***	0.693 ***
CV (Percent)	27.38	30.54	7.75
Instability	19.2	19.82	4.29

**** and ** significant at 1 and 5 percent level.*
Area (Lakh ha), Production (00 lakh tones) and productivity (T/ha)

Table 2. Input share in total input cost of sugarcane crop in Maharashtra

Particular	Sugarcane	
	Cost	Share (Percent)
Total Input cost	198425.93	100.00
Male	42632.24	10.87
Female	32700.99	16.48
Bullock labour	2207.96	1.11
Machine labour	15450.41	7.79
Seed / Set	18569.62	9.36
Manure	7048.44	3.55
Nitrogen	6580.77	3.32
Phosphorous	8665.71	4.37
Potash	4323.38	2.18
Irrigation	11741.91	5.92
Insecticide	478.33	0.24
Weedicide	1521.26	0.77
Interest on working capital	7255.33	3.66
Depression on farm implements	1488.21	0.75
Rental value of land	41991.16	21.16
Interest on fixed capital	3557.59	1.79
Other	9944.42	5.01

Other includes Incidental Charges, Repairs, Land Revenue, etc.

Table 3. Tornquist-Theil Divisia Index of output, input, and TFP of sugarcane crop in Maharashtra

Year	Sugarcane		
	Output index	Input index	TFP index
2003-04	100	100	100.00
2004-05	98.9	74.58	132.61
2005-06	71.42	88.3	80.88
2006-07	81.32	85.63	94.97
2007-08	100.03	88.57	112.94
2008-09	105.63	87.66	120.50
2009-10	124.57	91.5	136.14
2010-11	132.26	84.5	156.52
2011-12	124.07	112.2	110.58
2012-13	111.5	96.5	115.54
2013-14	118.16	102.68	115.08
2014-15	126.2	85.98	146.78

Table 4. Output, input and TFP indices growth rates of sugarcane crop in Maharashtra

Period	Sugarcane			
	Output index	Input index	TFP	TFP share in output (Percent)
Period I	3.70	1.09	2.59	70.00

(1.09 percent). Output index growth was also positive (3.70 percent). Total factor productivity growth was positive 2.59 percent.

From 12 agriculture seasons, twelve seasons were favorable for sugarcane cultivation in the Maharashtra. The output growth was achieved through spread of high yielding sugarcane varieties by sugar factories especially Co-86032, Co-94012 etc. sugarcane is a water-loving plant, it remains in the field almost for the year. Production technologies which increase the water use efficiency is directly benefiting towards output growth. By this reason, Government of Maharashtra provided subsidy on micro irrigation system to popularize it for providing irrigation and nutrient to the crop. The use of high yielding varieties, use of micro irrigation system for irrigation and nutrient applications, innovative planting system of sugarcane locally called as *patta-padhat* and use of residue to improve soil organic carbon are the important factors which bring the positive output growth leads to positive total factor productivity.

Factors Influencing Total Factor Productivity Growth in Maharashtra

In order to examine the effect of different factors on total factor productivity growth, log-linear regression equations were fitted as given in methodology. The step down multiple regression method was used to identify significant parameters by avoiding problem ofmulti co-linearity. The results obtained are presented in Table 5. The proportion area under high yielding varieties, rainfall, and road density were the important factors which have influence on total factor productivity sugarcane.

Table 5. Factors influencing total factor productivity growth of sugarcane in Maharashtra

Variables	Parameter estimate (bi)
Intercept a	-1.52
	(5.04)
Amount of loan (₹lakhs)	-0.80
	(0.51)
Proportion of double sown area	-1.55
	(1.10)
Proportion of high yielding variety	3.18**
	(1.99)
Rainfall (mm)	0.43**
	(0.32)
Number of villages electrified	-7.58
	(5.11)
Road density (km/hr)	2.79**
	(1.36)
$R^2 = 0.57$	

Figures in parentheses are standard errors.
*** Significant at 5 percent level.***

CONCLUSIONS

The compound growth rate in Area production and productivity of sugarcane over the study period shows increasing trend in all aspects but increase in production (10.07) is more because of increased area under sugarcane crop (8.17 percent) than that of increase in productivity (1.76 percent). Nearly 20 percent instability was found in area and production but in case of productivity, instability was only 4.29 percent. This clearly indicates that there is less variation (7.75 percent) in productivity of sugarcane in Maharashtra. The TFP growth rate was positive (2.59percent) in Maharashtra State, this is because of positive and increasing trend in output index (3.70 percent) and input index (1.09 percent). The share of TFP in total output is 70 percent this clearly indicates that with the increased use of inputs the output in the sugarcane crop increases, as well as technology, plays major role in increasing the production of sugarcane crop in Maharashtra. The highest total factor productivity was observed in the year 2014-15 (146.78 percent) and lowest total factor productivity (80.88 percent) was observed in the year 2005-06. The climatic conditions of agriculture year 2005-06 were unfavorable for sugarcane cultivation. From twelve agriculture seasons, ten seasons were favorable for sugarcane cultivation in Maharashtra. The positive TFP growth is because of technological and infrastructural breakthrough in sugarcane production system. It was also realized that an appropriate policy environment, infrastructure, institutions and favorable weather conditions were pre-conditions for a steady TFP growth in Maharashtra.

REFERENCES

Diewert, W.E. (1976). Exact and superlative index numbers. *Journal of Econometrics, 4*(2), 115-145.

Diewert, W.E. (1978). Superlative index numbers and consistency in aggregation. *Econometrics, 46*(4), 883-900.

Kumar, P., & Mruthyunjay. (1992). Measurement and analysis of total factor productivity growth in wheat. *Indian Journal of Agriculture Economics, 47*(3), 451- 458.

Kumar, P., & Rosegrant, M.W. (1994). Productivity and sources of growth for rice in India. *Economic and Political Weekly*, *47*(7), 183-188.

Pandya, M., & Shiyani, R.L. (2002). Analysis of total factor productivity growth in food crops of Gujarat. *Artha Vijnana, 44*(3-4), 367-374.

Rosegrant, M.W., & Evenson, R.E. (1994). Total factor productivity and sources of long-term growth in India agriculture. Paper Presented for *IFPRI/IARI Workshop in Agricultural growth in India*, May 1-6, New Delhi, India.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 27-32
DOI: 10.5958/2322-0430.2018.00031.8

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Potential of Traditional Irrigation System for Sustainable Development of Hill Agriculture

Arushi Vyas, Mahima G. Ghabru, and K.D. Sharma*

Department of Agricultural Economics, Extension Education & Rural Sociology
College of Agriculture, CSK HPKV, Palampur-176062

Corresponding author's email: mahimaghabru16@gmail.com

Received: December 29, 2017 *Manuscript Number: NS-18-45* *Revision Accepted: February 28, 2018*

ABSTRACT

The study was undertaken in command area of Lower Baijnath irrigation channel (Kuhl) having a culturable command area (CCA) of 552 hectares covering 27 villages in district Kangra of Himachal Pradesh. The main objective was to study the status and potential of traditional irrigation system and to explore the possibility of increasing farm income through optimum utilization of available farm resources. Stratified two-stage random sampling design was used to select six villages and 60 sample farmers. The primary data were collected from sample farmers through personal interview method using pre-tested survey schedule. Tabular analysis was extensively used to study farmer's participation in Kuhl management operations, availability,and regularity in supply of water, etc. The goal programming model was designed for the minimization of penalties keeping in view the prospects of higher income, food security and boundaries of resource constraints. Results revealed that water rights of using Kuhl irrigation were generally inherited from one generation to another. The distribution mechanism was such that the volume of water to each village wasbeing allocated in accordance with the cultivated area. About 74 percent respondents reported that around 71 percent of the area was irrigated by fetching Kuhl water on demand. About 14 percent of the farmers reported that water was available to them occasionally and not on regular basis to irrigate 18.46 percent of the cultivated area. The goal programming model revealed that adequate irrigation may yield efficient returns only when optimized farm plans are adopted by the farmers. The study showed that optimized plans with improved technology resulted in decrease in the area under paddy-wheat to around 49-60 percent from existing 80 percent that was reallocated to more profitable cropping systems, i.e. ginger-garlic, fodder crops and a polyhouse unit leading to substantial increase in returns. With the inclusion of a crossbred cow in the plan, more area was allocated to fodder based cropping systems which led to further increase in income. The study clearly highlighted scope for doubling farmers' income through adoption of improved technology, diversification of farming system with cultivation of profitable vegetable crops, adoption of hi-tech ventures like protected cultivation and inclusion of improved dairy animals as suggested through optimized model plans.

Keywords
Distribution, goal programming, Kuhls, optimized farm plans, people's participation, supply, water rights.

JEL Codes
C81, C61, Q01, Q25.

INTRODUCTION

Sustainability in agricultural production depends considerably upon proper development, conservation and optimum use of natural resources. Judicious use of natural resources is a must for enhancing the crop productivity and farm income, therefore, adequate usage of critical inputs viz., seed, fertilizers, irrigation etc. becomes the need of the hour. Among all the inputs, irrigation holds an important place as the input-use efficiency of other critical inputs depends considerably on it. Irrigation also plays a crucial role in risk mitigation, adaptation, and income enhancement by sustaining stable growth in farm production. The irrigation facilities enhance crop diversification and income through cultivation of high-value crops. However, water continues to be the scarce commodity not only for irrigation but even for drinking and other domestic uses. There is increasing competition for water across agriculture, industry and domestic uses leading to inter and intra-sector, state, district and village level conflicts. This clearly spells the need for judicious

operation, maintenance, and distribution of water sources. In hilly areas too, shortage of water has been experienced very frequently despite the fact that important rivers and their tributaries originate from mountain landscape. The existing water resources are further declining due to heavy biotic pressure and lack of judicious management of existing resources. Most of our agricultural crops are grown under rainfed conditions and this requires proper management of available water to be conserved for dry periods.

In the hill regions of Himachal Pradesh, the scope of boring tube-wells, construction of canals and even lift irrigation is limited; therefore, the most common source of irrigation remains the small water channels locally called *Kuhls* which account for 74.53 percent of the total area under irrigation in the state and as high as 88.29 percent in Kangra district. *Kuhls* provide adequate and timely water facilities to the farmers and meet irrigation requirements for the cultivation of crop for the entire year. There are wide variations in hydrological regimes and geographical features also that call for need to adopt different cropping systems for development of sustainable agriculture.

Cropping system is an integral part of farming system, thus, the need for sustainable development of agriculture with emphasis on cropping system approach is increasing for the management, conservation, and improvement of natural resources like water. It is essential to examine cropping system of a specified area in holistic perspective in a relatively homogenous agro-climate region for the purpose of effective planning and development of agriculture. However, the process of transformation and diversification of agriculture has remained confined to a narrow production base due to lack of necessary backward and forward linkages. Irrigated farming enhances the scope of multiple cropping, thereby, increasing cropping intensity and land productivity. Therefore, more output per unit of land becomes critical when per capita availability of cultivated land is shrinking particularly in hills. In this endeavour, irrigation facilities tilt the cropping pattern towards more profitable crop combination enhancing income and employment opportunities for farmers. This study was undertaken in Lower Baijnath area of Kangra district with the objective of studying the traditional irrigation structures and to explore the possibility of increasing farm income through optimum utilization of available farm resources.

DATA AND METHODOLOGY

This study was carried out in a command area of an irrigation channel having a culturable command area (CCA) of 552 hectares covering 27 villages in district Kangra of Himachal Pradesh. Stratified two-stage random sampling design was used to select six villages and 60 sample farmers. The primary data were collected from sample farmers through personal interview method using pre-tested survey schedule. Tabular analysis was extensively used to study farmer's participation in *Kuhl* management operations, availability, and regularity in supply of water, etc. The goal programming model was designed for the minimization of penalties keeping in view the prospects of higher income, food security and boundaries of resource constraints (land, labour, capital, etc.) by including different alternatives/enterprises, their inter-relations/inter-linkages, technological options, and constraints. Software package LINGO 10.0 version was employed for this analysis.

The mathematical form of goal optimization model employed in this study is as under:

$$\text{Minimise } Z \quad {}_{j\ 1}^{n} P_j (Y_j \quad Y_j) \text{ (j = 1, 2, 3……., n)}$$

Subject to the following resource constraints;

$$_{k\ 1}^{I} a_{ik} X_k \quad (Y_j \quad Y_j) \quad b_i \text{ (k=1, 2, 3…., l, andi=1,2,3… m)}$$

and,

$$X_{ke}\ Y_j \text{ and } Y_j \quad 0$$

P_j = Penalty for not achieving the jth goal
Y_j = Overshooting the jth assigned goal
Y_j = Underachieving the jth assigned goa
a_{ik} = Unit contribution/requirement or input-output relationship
X_k = Number of activities (cropping systems and other enterprises)
b_i = Level of ith constraint

The goals/objectives have been assigned different penalties. The objectives/goals specified are:

i. Land must be fully utilized and there should not be over or under-utilization of the cropped land, thus, high penalties for under or overuse of land.
ii. The returns should be increased to the maximum feasible extent by selecting profitable cropping system/enterprise-mix.
iii. Food security should be achieved as far as possible *i.e.* the minimum production of cereals required for meeting family consumption.
iv. Minimum green fodder production either for sale or use for maintaining at least one milch animal on the farm.
v. Poly-house area per farm should not exceed 105 m^{2}due to management constraint.
vi. At least one milch animal per farm for nutrition security and to augment farm income.

Different optimized plans were developed to achieve these goals keeping in view the following conditions:

1. P_1 = optimized cropping system plan with existing technology
2. P_2= optimized cropping system plan with a polyhouse unit of 105m^2

3. P_3 = optimized cropping system plan with improved technology
4. P_4 = optimized cropping system plan with improved technology and a polyhouse unit of 105m^2 area
5. P_5 = optimized cropping system plan with improved technology, a polyhouse and a dairy animal (cow)

RESULTS AND DISCUSSION

Water Rights and Distribution Pattern

Irrigation is a way of life for farmers to manipulate existing water sources to either store or distribute them for crop production. In Kangra valley, streams, rivulets (*nullahs*) and rivers (*khads*) are the major sources of irrigation water in the valley where from the water is conducted with gravitational flow to the cultivated area, through numerous narrow cuts like canals locally known as *Kuhls*. Water rights of using *Kuhl* irrigation are generally inherited from one generation to another. Every household owning land in a village falling in the command area hasthe rights to demand and use LB *Kuhl* irrigation water. Table 1 presents the water rights and average flow of *Kuhl* water in sample villages. The distribution mechanism is such that the volume of water to each village is allocated in accordance with the cultivated area. In accordance with cultivated area, maximum water discharge (255.60 cubic meters per hour) to Girtholi village and minimum (28.80 cubic meters per hour) to village Mahalpat. According to IPH Department, the water discharge may increase or decrease by 20 to 30 percent depending upon availability at the source. Moreover, water distribution to a particular village may also vary in accordance with the demand intensity of farmers. Therefore, at the time of shortage, there is a *warabandi* system according to which water flow may be increased in a particular branch by decreasing flow in the other branches. This practice was generally followed during *Rabi* and summer seasons when there is water shortage. Chand (1994) suggested that for the efficient and equitable performance of *Kuhls*, beneficiary farmers be accorded well defined and legally enforceable water rights by encouraging the formation of water user's associations.

Table 1. Water rights and distribution of irrigation water to sample villages

Branches	Cultivated area (ha)	Water discharge (cubic metre/hour)
Main branch		
i.Girtholi	71.00	255.60
ii.Thara	20.00	72.00
Subsidiary branches		
Ustehar branch		
i.Ustehar	38.76	139.53
ii.Mahalpat	10.00	28.80
Nagehar branch		
i.Mandhol	42.00	151.20
ii.Bandian	16.50	44.55

Source: Irrigation & Public Health Department, Sub-Division Baijnath.

Perceived Changes in LB *Kuhl* Management System

The perusal of Table 2 shows the changes that have taken place from traditional system of *Kuhl* irrigation to the present system of irrigation in the command area of LB *Kuhl*. Earlier, there was a *Kohli* who managed all the *Kuhl* operations along with local people participation but now, there was neither a *Kohli* nor any *Kuhl* committee. Presently, LB *Kuhl* was under Irrigation & Public Health (IPH) Department located in Baijnath. *Kuhls* were *Kucha* in nature earlier but now the *Kuhls*have been changed to *pucca* nature by providing stone lining. Farmer's participation has reduced from participating in complete management operations of LB *Kuhl* to partial management operations. It was reported by 86.67 percent of the farmers that water quality in the LB *Kuhl* has deteriorated while about 12 percent of the farmers reported that water quality remained same as in the traditional system. In the main branch, all the farmers reported deterioration in the water quality which was mainly due to contamination of sewage water and disposal of garbage in the *Kuhl*.

Availability and Regularity in Supply of LB *Kuhl* Water

Table 3 shows the availability and regularity in supply of LB *Kuhl* water to the command area. About 74 percent respondents reported that around 71 percent of the area was irrigated by fetching *Kuhl* water on demand. About 14 percent of the farmers reported that water was available to them occasionally and not on regular basis to irrigate 18.46 percent of the cultivated area. About 12 percent of the farmers got regular supply of water to irrigate 10.74 percent of the land. The regularity in the supply of water was only reported by about 19 percent of the farmers in subsidiary branches. Sharma *et al.* (2015) also reported that earlier *Kuhls* used to run 340 to 350 days annually on their own in 1989 whereas nowadays, these water channels had been running only for 25 to 50 days.

Problems and Constraints

The perusal of Table 4 shows the problems related to management of *Kuhl.* Most of the farmers (*Kuhl* users) have reported the menace of disposal of garbage in *Kuhls* as the major problem followed by the contamination of sewage water and irregular water flow. The respondents also reported non-availability of *Kuhl* water during summer season. Losses due to seepage especially during rainy season and lack of regular maintenance and repair by Irrigation & Public Health Department were also reported problems that need due attention.

Optimum Farming Systems for Augmenting Farmer's Income

The optimum farming/cropping system plans have

been developed with multiple objectives comprising enhanced returns, food and nutrition security (milk availability) on the farm. These integrated plans have been developed both under existing as well as improved level of technology with and without capital borrowing. The profitable enterprises like protected cultivation as well as dairy have also been incorporated to examine the possibility of increasing farm income and employment avenues on the farm.

Under existing set up, the farmers were patronizing number of cropping systems and the maximum area was allocated under paddy-wheat cropping system (80.52 percent) followed by paddy-berseem (4.76 percent) and soybean-potato (4.52 percent) cropping systems. The area

Table 2. Changes in LB *Kuhl* management and operation

(Percent response)

Particulars	Traditional System			Existing System		
	Main branch	Subsidiary branches	Overall	Main branch	Subsidiary branches	Overall
Presence of committee						
i. *Kohli*	100.00	100.00	100.00	-	-	-
ii. *Kuhl* committee	-	-	-	-	-	-
iii. IPH Department	-	-	-	100.00	100.00	100.00
Nature of*Kuhl*						
i. *Kucha*	100.00	100.00	100.00	-	-	-
ii. *Pucca*	-	-	-	77.27	44.74	56.67
iii. Mixed (*kucha+pucca*)	-	-	-	22.73	55.26	43.33
Farmer's participation for cleaning of *Kuhl*						
i. Complete participation	100.00	100.00	100.00	-	-	-
ii. Partial participation	-	-	-	100.00	100.00	100.00
Water availability						
i. Remained same	100.00	100.00	100.00	68.18	47.37	55.00
ii. Improved	-	-	-	-	-	-
iii. Decreased	-	-	-	31.82	52.63	45.00
Distribution mechanism						
i. Traditional (*path*)	100.00	100.00	100.00	-	-	-
ii. Modern (measuring device)	-	-	-	100.00	100.00	100.00
Maintenance & repair by farmers						
i. Complete participation	100.00	100.00	100.00	-	-	-
ii. Partial participation	-	-	-	100.00	100.00	100.00
Conflict resolution mechanism						
i. *Kohl*	100.00	100.00	100.00	-	-	-
ii. *Panchayat* settlement	-	-	-	18.18	42.11	33.33
iii. Mutual settlement	-	-	-	81.82	57.89	66.67
Water quality						
i. Remained same	100.00	100.00	100.00	27.27	2.63	11.67
ii. Improved				-	2.63	1.66
iii.Deteriorated	-	-	-	72.73	94.74	86.67

Table 3. Farmer's response about availability and regularity in supply of irrigation water

Particulars	Main branch		Subsidiary branches		Overall	
	Percent farmer	Percent area	Percent farmer	Percent area	Percent farmer	Percent area
Water available regularly	-	-	18.92	17.53	12.07	10.74
Water available on demand	100.00	100.00	59.46	52.33	74.14	70.81
Water occasionally available	-	-	21.62	30.14	13.79	18.46

under optimized plan with borrowing (P_1) was distributed under paddy-wheat (71.52percent), sorghum (*chari*)-berseem (19.52 percent) and ginger-garlic (8.86percent) cropping systems. In case of optimized cropping system plan with capital borrowing and a polyhouse (P_2), 71.48 percent area was allocated under paddy-wheat followed by sorghum (*chari*)-berseem (19.52 percent) cropping system while 5 percent area was allocated under polyhouse unit (maximum limit). Under P_3 cropping system, that is, under improved technology with capital borrowings, 48.52 percent of the area was allocated under paddy-wheat cropping system followed by paddy-berseem (35.24 percent) and more area under ginger-garlic (16.24 percent) cropping system being most profitable, Under improved conditions with capital borrowing and a polyhouse (P_4), are distributed under paddy-wheat and paddy-berseem remainedsame as in P_3while area under ginger-garlic got reduced to 11.24 percent sparing 5 percent area from ginger-garlic cropping system to more profitable polyhouse unit. Finally, with the inclusion of a crossbred milch cow (P_5) in the optimized cropping system plans under improved technology, more area was distributed under paddy-wheat (65.95 percent) and sorghum (*chari*)-berseem (17.62 percent). About 16 percent area was shifted to ginger-garlic cropping system.

Table 6further shows the goals achieved in various optimized cropping system plans. The returns to fixed farm resources could be increased from ₹31,788 (farmer's plan) to ₹86,927 (optimized plan with improved technology and a milch cow). The foodgrain production would be reduced to 6.30 q/farmfrom10.37 q/farm in optimized plans which were sufficient to meet the family consumption needs. The milk availability would increase from 1409 (P_1 to P_4) to 2748 litres/farm in P_5 leading to increase in farmer'sincome besides meeting family consumption requirement that was sufficient to meet nutritional requirement of family as well as increase farm income. Green fodder production would increase from 11q/farm to 37q/farm to meet the requirement of a crossbred cow.

However, the credit required also increased with the adoption of improved technology and diversification of farming system with the inclusion of cash crops, protected cultivation and improved cow incurring more cash variable expenses on seeds, inputs and human labour. Labour employment increased in optimized cropping system plans from existing 41.38 man-days to 141.09 man-days, maximum being in P_5.

Table 4. Ranking of problems related to management of *Kuhl*

Problems	Severity ranks				Total respondents	Total score	Average score	Rank
	I	II	III	IV				
Garbage disposal in *Kuhls*	48	12	0	0	60	4176	69.60	1
Contamination of sewage water	48	12	0	0	60	4176	69.60	2
Irregular water flow	18	27	11	4	60	3418	56.97	3
Non-availability of water during summer	9	44	5	2	60	3395	56.58	4
Losses due to seepage	2	49	8	1	60	3269	54.48	5
Lack of regular maintenance and repair	2	27	26	5	60	2937	48.95	6
Weed infestation in *kuhl*	1	32	20	7	60	2934	48.90	7
Conflicts for distribution of *kuhl*water among farmers	0	11	41	8	60	2636	43.93	8
Kucha nature of some parts of *kuhl*	0	6	13	41	60	2015	33.58	9
Excess command area creating shortage of water discharge	0	0	0	60	60	1620	27.00	10

Table 5. Land allocation under existing and optimized farming system plans

(Percent area)

Farming systems	Farmers' existing	P_1	P_2	P_3	P_4	P_5
Paddy-Wheat	80.52	71.52	71.48	48.52	48.52	65.95
Paddy-Berseem	4.76	0.10	0.10	35.24	35.24	-
Soybean-Potato	4.52	-	-	-	-	-
Sorghum (*chari*)-Potato	4.33	-	-	-	-	-
Ginger-Garlic	1.10	8.86	3.90	16.24	11.24	16.43
Sorghum (*chari*)-Berseem	0.67	19.52	19.52	-	-	17.62
Polyhouse (105 m^2)	-	-	5.00	-	5.00	-
Others	4.10	-	-	-	-	-
Total	100	100	100	100	100	100
	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)

Figures in parentheses show cultivated area in ha/farm. P_5 also includes one improved cow in the plan.

Table 6. Resource use and extent of goals achieved under optimized plans for LB *Kuhl*

(Per farm)

Particulars	Farmers' plan	P_1	P_2	P_3	P_4	P_5
Income (RFFR ₹)	31788	34438	40566	58003	66974	86927
Foodgrain availability (q)	10.37	6.30	6.30	6.30	6.30	6.30
Milk availability (litres)	1409	1409	1409	1409	1409	2748
Credit needs (₹)	-	7659	3559	16297	15452	26235
Human labour used (days)	41.38	42.84	59.97	52.01	74.07	141.09

Increase in milk availability in P_5 due to inclusion of a crossbred cow.

In this way, the returns over farmers' plan could be doubled or even more than doubled in P_4 and P_5 when improved technology along with hi-tech polyhouse unit and an improved milch cow were included. This clearly shows that improved technology and proper enterprise-mix on the farm are the key ingredients of doubling farmers' income.

CONCLUSIONS

The study clearly shows the importance of traditional irrigation structures in improving the product as these are perennial supplies which if adequately managed can provide timely and adequate irrigation. Regular repair and maintenance work of *Kuhl* should be ensured to check seepage losses, especially during rainy season. Water resources should be managed in a manner that promotes a participatory approach and involves local communities in the management operations. Community awareness should be created for keeping *Kuhls* garbage free and penalties should be imposed for disposal of garbage and sewage water in *Kuhls*. Water user's associations and the local bodies such as gram *panchayats* should be actively involved in this cause. The results of goal programming model revealed that resources could be efficiently used and farm income could be enhanced without compromising food security by patronizing profitable cropping system with improved technology and incorporating polyhouse as well as improved milch animal. There are ample opportunities for doubling farmers' income through adoption of improved technology and diversification of farming system with cultivation of profitable vegetable crops, adoption of hi-tech ventures like protected cultivation and inclusion of improved dairy animals as suggested through optimized model plans.

REFERENCES

Chand, R**.** (1994). Role of water rights in farmer-managed hill irrigation systems**.** *Economic and Political Weekly, 29*(13), A26-A30.

Sharma, A.K., Sharma, K.D., & Brahm, P. (2015). Death of *Kuhl*irrigation system of Kangra valley of Himachal Pradesh: Institutional arrangements and technological options for revival. *Indian Journal of Agricultural Economics*, *70*(3): 350-364.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 33-40
DOI: 10.5958/2322-0430.2018.00032.X

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Development of Optimum Farm Plans for Enhancing Farmers Income in Agrarianly Distressed Marathwada through Multi-Criteria Decision Making in Farm Planning[§]

Vishal S. Thorat[1] and Smita Sirohi[2]*

[1]*Navsari Agricultural University, Navsari-396450 (Gujarat)*
[2]*Division of Dairy Economics, Statistics, and management, National Dairy Research Institute, Karnal – 132001 (Haryana)*

[*]*Corresponding author's email: vishal.lotus@gmail.com*

Received: December 29, 2017 *Manuscript Number: NS-18-51* *Revision Accepted: February 28, 2018*

ABSTRACT

In the middle of the agrarian distressed scenario, government focusing on special efforts in realigning its interventions to move from 'production-centric' to 'farmers' income-centric' platform. As documented by NITI Ayog, efficient use of farm resources forms one of the major sources of growing farmers' income operating within agriculture sector. As farmers have multiple goals running through his mind, it was crucial to think beyond traditional single objective resource optimization to multiple objective decisions making. In this concern, this study aimed to develop optimum farm plans considering the combination of crop and dairy enterprises subject to limited availability of farm resources. Primary data pertaining to crop and dairy enterprises were collected from 100 dairy farm households in Latur district of Marathwada as the district forms the best representation of agrarian distress in the region. The analytical technique used was multi-criteria goal programming model. It was found that marginal and small farmers have the highest aspiration level than other farming categories in goals such as net return and total production. Optimum farm plan for landless dairy households suggests that replacement of crossbred to indigenous cow can enhance net return from existing ₹36211 to ₹51118 and total production from 45 quintals to 70 quintals per annum. Farm plan for marginal and small farmers can increase income to ₹130000 from existing ₹64174.47. Suggested combination of farm resources for medium and large farmers enhances the income to ₹320000 and ₹450000 desired by farmers from existing ₹180156 and ₹278737 respectively. Optimum farm plans for all the farming categories suggest shifting the area under soybean and wheat to tur and gram and inclusion of high productive milch animal species instead low productive indigenous cattle. The suggested optimum plan can have its positive impact on the returns of households only in presence of proper institutional revamp.

Keywords
Agrarian distress, Goal programming, Marathwada.

JEL Codes
C61, E64, Q12, Q18.

INTRODUCTION

In the arena of distress among the farming community, the government came up with a target of doubling farmers real income by the year 2022-23 emphasizing on multi-directional efforts. One of the major sources of growth in farmers' income is resource use efficiency or savings in cost of production (Chand, 2017). In this concern, optimization of resource use seems one of the major way outs enhancing resource efficiency and thereby the income of resource-poor farmers.

Marathwada, a high drought-prone zone has least irrigation connectivity accompanying with below average rainfall manifested in emerging center of agrarian distress in the state of Maharashtra. According to crop statistics from Department of Agriculture (n.d.), out of 8 districts in the region, production and productivity figures for 2010-11 and 2011-12 reveals that Latur and Jalana districts were more susceptible for the adverse environmental risks. Production of total *kharif* foodgrains drastically came down from 0.35 million tonnes in 2010-11 to 0.25 million tonnes in 2011-12 in Latur district. The trends were quite similar to Jalana district. The

[§]***The paper is a part of Ph.D. work (2017) of the first author that was undertaken at DES&M, NDRI, Karnal***

productivity of total *kharif* foodgrains in Latur also shows a decline from 1110 kg/ha. In 2010-11 to 989 kg/ha in 2011-12. Other districts such as Osmanabad, Nanded, Parbhani, Hingoli in the region shows some gain in productivity of total *kharif* foodgrains during the same time periods. The productivity of total foodgrains (*Kharif* & *Rabi*) also showed a reduction from 1057 kg/ha to 1015 kg/ha from 2010-11 to 2011-12 in Latur district which was higher difference than the other districts in the region excluding Jalana. Moreover, the productivity of total oilseeds has declined from 1824 kg/ha in 2010-11 to 1490 kg/ha in 2011-12 which was the highest decrease among the 8 districts in the region. Thus, it can be perceived that Latur district may form the better representation to study the agrarian distress in the Marathwada region of Maharashtra. The optimum use of available resources in order to achieve desired income level may serve the purpose of recent policy initiatives towards reducing distress among agrarian community through an increase in farmers' income. In this context, this study made sincere efforts to form optimal farm plan with the combination of crop and livestock enterprises, so as to reap aspired income of farmers in the study area.

METHODOLOGY

Marathwada region was purposively selected for the study due to the existence of high rain based farming and degree of agrarian distress. From Marathwada region, Latur district was selected purposively. The purpose of the selection of Latur as a study area is well discussed in the previous section. Out of total 10 tehsils in the district, two tehsils were selected randomly. Further, two villages from each tehsil were randomly selected for acquiring primary information from the farmers' respondents.

A complete enumeration of households in selected villages was carried out to gather information on landholding and herd size of milch animals. The population for sample selection comprised of households that possessed at least one milch animal. A sample of 100 livestock farmers belonging to different landholding category (landless, marginal+small, medium and large) was selected randomly from the chosen villages with probability proportional to the number of households in each village and each land size category. The data on land holding, size, and composition of livestock, expenditure and income from crop and livestock enterprises, maximum availability of resources like labour, feed fodder, working capital etc. has been collected relating to the year 2012-13 with the help of pre-structured and pre-tested interview schedule from the selected farmers' respondents.

Analytical Technique

Farmers are running with multiple goals in their mind. It has been confirmed in many studies (Soon, 1983; Pertiwi *et al.*, 1992; Bulatovic, 1997; Aromolaran & Olayemi 1999; Saha, 2003) that it is not profitability alone that guides farmer's decision making in selection of activities or enterprises for fulfillment of their needs but in reality, farmer has multiple targets in his mind. These multiple targets cannot be fully achieved but are too important to be ignored in farm planning. The need to find balance among multiple objectives in farming is now well established (Harper & Eastman, 1980).

Several approaches have been developed in management science to deal with multiple criterion decision making (Cohon, 1978; Zeleny, 1982). Of these techniques, goal programming (GP) has been applied to wide-ranging problems (Lin, 1980). Thus, instead of single objective optimization of resource, multiple objective optimizations have been performed by using goal programming technique.

Setting of Goals

As there were several goals to deal with, some important were considered to run the model. Farmer's preferences towards each goal have been finalized through ranking percentage. The major goals include:

Maximum total net income

The net income from an enterprise is its output less the variable cost incurred. To set the goal of total gross income, farmers aspiration level taken into consideration. The goal achievement function for total gross income formulated as:

$$\min \; ry(d \quad , d \quad) \quad d\overline{y}$$

Subject to,

$$\underset{j}{\quad} g_{yi} x_j \quad d\overline{y} \quad dy \quad G_y$$

Where, d^- and d^+ denotes under and over achievement of gross income, gy_i represents the mean net income per unit of jth crop/dairy enterprise and G_y is the goal of total net income.

Maximization of Crop and Livestock Production

This was obtained by the product of the area estimate with corresponding yield estimate for the particular crop/livestock. In case of livestock, the yield of three livestock species i.e. buffalo, crossbred and local cattle was taken as a separate enterprise. The goal equation for crop and livestock production can be expressed as,

$$\min \; r_p(d \quad , d \quad) \quad d\overline{p}$$

Subject to,

$$\underset{j}{\quad} g_{pi} x_j \quad d\overline{p} \quad dp \quad G_p$$

Where, d^- and d^+ denotes under and over achievement of expected total production goal, gp_i represents the mean of the yield of the jth crop/dairy enterprise and G_p is the goal of total expected production.

Minimization Cost Deviation among Different Enterprises

In order to minimize risk cost deviation from minimum for each enterprise was considered as a parameter. Cost of production of each enterprise for every household was deducted from the minimum cost of production of that particular enterprise among the households in that particular landholding category to

arrive at cost deviation from the minimum. Further, an average of absolute cost deviation was taken for each enterprise. The goal set was a possible minimum figure which is around half of the actual total cost deviation. The goal achievement function for cost deviation formulated as:

$$\min \; r_r (d \quad , d \quad) \quad d\overline{p}$$

Subject to,

$$\underset{j}{\quad} g_{ri} x_j \quad d\overline{r} \quad dr \quad G_r$$

Where, d^- and d^+ denotes under and overachievement for total cost deviation, gr_i represents the average cost deviation for j^{th} enterprise and G_r is the goal of total cost deviation for the particular farming system.

Goals or constraint were set in accordance with the parameters those may help to enhance the resilience of households against risks. After specification of goals and aspiration levels, ranking or prioritization of set goals was done based on the percentage of household's preference ranking for all the four categories of farmers.

Absolute Constraints

Absolute constraints generally comprise production capacities, structural and functional limitations. The constraints considered were:

1. Maximum land availability (Ha)
2. Maximum human labour availability (family and temporary) (man-days)
3. Maximum working capital constraint for each enterprise per unit (₹)
4. Maximum feed & fodder availability (Qtls.)
5. Minimum requirement of wheat for meeting family consumption (Qtls.)

The absolute constraints comprising of all the items mentioned above can be expressed in mathematical form as under:

$$\underset{j}{\quad} b_{iji} x_j \quad d\overline{i} \quad d_i \quad B_i, i \quad 1,2,....n$$

Where b_{ij} is the technical requirement of the jth decision variable for i^{th} resource constraint.

X_j refers to the vector of 'n' activities in the model

d_i *and* d_i are absolute constraint deviation variables which denote, respectively under and over-utilization of the ith absolute constraint.

B_i is i^{th} absolute constraint level

Model Formulation

Recognizing the difficulty in working out the suitable plans for each of the selected households individually, the resource and availability data of the selected respondents of the selected farming system were pooled together and averaged to form solid farm situation representing each farming system. In the study area, major seven crop enterprises were dominant in two seasons. In Kharif season Jowar, Tur, and Soyabean were the major crops while in Rabi Wheat and Gram were being produced. Sugarcane was also grown by some farmers which take a year to generate benefits.

The mathematical formulation of the model was framed considering socio-demographic characters of farm households, the interaction between two major enterprises dairy and farm in terms of labour availability, resource availability, cash needs and cash availability at regular interval and the requirement and availability of temporary and family labour.

The major income sources of farm households in the study area were crop and dairy activities. As the cost and return parameters of inputs and outputs for the various activities in different landholding category varies, separate models were fitted for various farming systems.

Farm Planning Model

The comprehensive farm planning model for different systems with goal achievement function, the absolute constraints, the goal constraints and non-negativity of variables is given below-

Find X = (X_1, X_2, X_3, … … … … . , X_n) so as to minimize

$$Z \quad (p_1 d_y , p_2 d_p , p_3 d_r)$$

Subject to

$$\underset{j}{\quad} b_{yi} x_j \quad d\overline{y} \quad d_y \quad G_y$$

$$\underset{j}{\quad} b_{pi} x_j \quad d\overline{p} \quad d_p \quad G_p$$

$$\underset{j}{\quad} b_{ri} x_j \quad d\overline{r} \quad d_r \quad G_r$$

$$\underset{j}{\quad} b_{iji} x_j \quad d\overline{i} \quad d_i \quad B_i, i \quad 1,2,....n$$

$X, d^-, d^+ \geq 0$

Where d_y *and* d_y denotes under and over achievement of net income

d_p *and* d_p denotes under and over achievement of expected total production goal

d_r *and* d_r denotes under and over-achievement for total cost deviation

gy_i represents the mean net income per unit of jth crop/dairy enterprise

gp_i represents the mean of the yield of the jth crop/dairy enterprise

gr_i represents the average cost deviation for j^{th} enterprise

G_y, G_p and G_r are the goal of total gross income, expected total production and total cost deviation for different farming system respectively.

b_{ij} is a technical requirement of the jth decision variable for i^{th} resource constraint.

X_j refers to the vector of 'n' activities in the model

d_I *and* d_I are absolute constraint deviation variables which denote, respectively under and over-utilization of the ith absolute constraint.

B_i is i^{th} absolute constraint level

RESULTS AND DISCUSSION

Optimum farm plans were developed by using lexicographic goal Programming which deals with multiple goals and no single goal of maximization of net return.

Optimization Goal and Targets

Three major ones that enquired based on the sample survey in order of priority were: maximization of net profit (G1), maximization of total production from crop and dairy enterprises (G2) and minimization of difference in cost of production with reference to the lowest cost achievable by other farmers (G3). The most crucial part of running the model was finalizing the target levels of each of the three goals considered in the study. In both the regions, for all four farming categories, targets were fixed according to aspiration level of each farmer in that specific category. Finally, an average of aspiration levels of all farmers was rounded off to set one final target of particular goal for the particular farming category. Target levels vary with farming category and region (Table 1). Landless farmers possessing dairy animals have aspiration level of 38 percent higher net income to that of actual net income. Whereas, marginal and small farmers sought double income to that of actual. Medium and large farmers in the study area desired 78 and 61 percent hike in net returns respectively. Aspiration levels of total production goal were comparable among the various land size categories. Marginal and small farming category seeks highest increment (71 percent) in total production than actual among all the farming categories. Large farmers desired to have at least 17 percent increase in their total production to that of actual whereas landless and medium farming households desired around 30percent gain in total output from crop and livestock activities.

Farmers were unaware of the magnitude of required cost-cutting in order to accomplish desired net returns. Thus, target levels for the third goal of minimization of cost deviation were taken half of the existing average cost deviation throughout the farming categories in the study area at the prices in the year 2012-13.

Optimum farm plans

As stated earlier, crop and dairy activities were considered for the formation of the optimum farm plan. The major crop activities considered for developing farm plan were tur, soybean, jowar, and sugarcane in kharif and wheat and gram in rabi season. In case of dairy, since all three types of milch animal, viz. indigenous cow (IC), crossbred (CB) and Buffalo (B) were reared in the region; all three were considered as separate activities in the optimization model.

Farm plan for landless dairy households

Average animal herd size for this category was observed three one each of indigenous cattle, crossbred and buffalo. The feeding of dairy animals was solely carried out by purchased feed and fodder and grazing lands like fields, roadside and open pastures, tree leaves etc.

Results presented in Table 2 shows that in the study area, indigenous cattle replaced by crossbred in the optimal plan in order to increase net income from existing ₹36211 to ₹51118 which is around 41 percent hike

Table 1. Summary of the goals and the desired achievement function

Goals	Targets				Deviation variables
	Landless	Marginal and small	Medium	Large	
G_1	50000 (38)	130000 (100)	320000 (78)	450000 (61)	Minimize underachievement
G_2	60 (33)	125 (71)	350 (30)	575 (17)	Minimize underachievement
G_3	500 (-50)	15100 (-50)	24000 (-50)	29500 (-50)	Minimize overachievement

G_1: Maximization of Net Return (₹)/annum G_2: Maximization of Output (q)/annum G_3: Minimization of Cost Deviation (₹)/annum).
Figures in parenthesis are percentage above (+) and below (-) the existing value.

Table 2. Optimal plan for landless farming households

Enterprise	Animal herd (No.)		Annual net returns (₹)		Total output (q)		Cost deviation (₹)	
	Existing	Observed	Existing	Observed	Existing	Observed	Existing	Observed
IC	1	0	5616	0	5.65	0.00	917	846
CB	1	2	20523	41046	30.45	60.90		
B	1	1	10072	10072	9.20	9.20		
Total	3	3	36211	51118	45.30	70.10		

overachieving the target of 38 percent. By undertaking this suggested plan by the model, production could be increased by 55 percent from existing 45.30 q to 70.10 q Thus, first, two goals of higher priorities were actually overachieved as resulting figure surpassed the actual target levels. The goal of minimum cost deviation which was of lower priority was partially achieved as it missed its target of ₹500 by the minute positive deviation of Rs 346. But with the close perusal, this achieved figure of cost deviation was still lower than actual (₹917).

Thus, landless dairy households in the study area have scope to achieve their desired level of net return and total production by changing the composition of the herd. Shifting from low productive animals to high productive animals, they can increase the production and thereby income in the scenario of stable prices. Despite little more keeping the cost of crossbred, the availability of resources allows them to increase one crossbred in existing herd size by opting out low productive local cattle breed from the system.

Farm plan for marginal and small farming households

The close scrutiny of Table 3 reveals that, under the condition of existing available resources, the optimal plan suggested reallocation of resources among crop and dairy enterprises. In Marathwada, the optimal plan suggested switching over to crossbred from indigenous cattle and buffalo based dairy system. Instead of rearing indigenous cow and buffalo, it would be more beneficial for the farmers to rear crossbred. Further, the model suggested opting out Soybean from the optimal farm plan and reduction in the area under Jowar in kharif and Wheat in rabi season. However, the model suggested an increase in the area under Tur in Kharif and Gram in rabi season from 1.31 acres to 3.31 acres and 1.88 acres to 3.14 acres respectively. It can be seen that the top priority goal of maximization of net return was fully achieved by optimal farm plan while rest of two goals were partially achieved. Net return increased to ₹130000 from existing ₹64174.47 indicating almost doubling of the income. Total production increased from existing 73.15 . to 118.75 q. falling short by 6.25 q of the targeted 125 q but still increase in production seemed sizable in order to the financial upliftment of farming households. The target of achieving average cost deviation of ₹15100 which was half of the actual was overachieved with the negative deviation of ₹2709 which indicates lowering of the risk through implementation of suggested optimum plan.

Farm plan for medium farming households

Table 4 shows that the optimal plan suggested by the model need a reallocation of existing resources among various crops and dairy enterprises. The plan suggested replacement of existing one indigenous cattle and one buffalo by 2 crossbred keeping herd size unchanged at 3. Further model directed to eliminate Soybean from the cropping pattern in Kharif and increase the area of Tur from existing 4.40 to 10.74 acres due to its relative income generating ability. Most of the medium farmers take Sugarcane as a cash crop in the study area. The model suggested decreasing area under Sugarcane from 2.58 to 1.29 acres in the optimal plan as it is highly resourced intensive crop. The area under Jowar in Kharif season slightly decreased from 2.53 to 2.43 acres in the optimal plan. In Rabi season model shows the shifting of the area from Wheat to Gram. The area under Wheat decreased from 8.75 to 1.65 acres and that of under Gram increased from 3.14 to 11.55 acres in the optimal plan.

The high priority goal of maximization of net return was fully achieved as optimal plan generated income of targeted ₹320000 from the existing ₹180156. Thus, the optimal plan was capable to achieve the desired target of net profit desired by farmers. A second priority goal of maximization of total production was slightly underachieved as it gave total production of 295.09 q which was negatively deviated by 54.91 q by the target of 350 q still the total production given by optimal plan was higher than the actual production. Further, the goal of minimization of cost deviation was almost fully achieved by given optimal plan with a minute positive deviation of ₹44 by the target of ₹24350 (Appendix).

Table 3. Optimal plan for marginal & small farming households

Enterprise	Land, animal allocation (acres)		Annual net returns (₹)		Total output (q)		Cost deviation (₹)	
	Existing	Observed	Existing	Observed	Existing	Observed	Existing	Observed
Tur	1.31	3.31	15211	40011	8.63	25.78	30165	12391
Soyabean	1.48	0.00	8463	0	14.22	0.00		
Jowar	1.00	0.48	1932	926	9.15	3.91		
Wheat	1.91	0.65	6004	2025	14.72	5.01		
Gram	1.88	3.14	20410	42019	11.38	23.14		
IC	1	0	3958	0	5.90	0.00		
CB	0	2	0	45044	0.00	60.90		
B	1	0	8196	0	9.15	0.00		
Total	3.79, 2	3.79, 2	64174	130026	73.15	118.75		

Farm plan for large farming households

Results presented in Table 5 shows that animal herd size large farming category declined from 4 to 3 in the optimal plan. Indigenous cattle have been removed from the optimal plan and added one crossbred. Model retained existing buffalo in the optimal plan. In crop enterprise, the model suggested reallocation of land among various crops in Kharif and Rabi season. Soybean didn't make a place in the optimal plan losing its area to Tur as usual in Kharif season. The area under Tur increased more than two-fold from existing 8 acres to 16.91 acres in the optimal plan. Jowar and Sugarcane lost some of the land under them to Tur as the area under these crops decreased from 4.98 and 9.13 acres to 2.85 and 6.75 acres respectively. Sugarcane is the cash crop mostly grown by medium and large farmers in the study area is highly resource intensive. Existing resource availability could not make to enhance its productivity comparable to that of in Western Maharashtra. Hence, is the reason optimal plan curbed area under the crop to make production system more viable and feasible? The further area under Wheat in Rabi season declined from 11.40 to 3.02 acres under the optimal plan. This reduced area under Wheat shifted to Gram as its area has increased from 5.98 to 16.74 acres in the optimal plan. Thus, the reallocation of land among the crop enterprise indicated that more resource should be allocated to pulse crops rather than traditional cereals.

The first priority goal of maximization of net return has been satisfied by the optimal plan as it generated the targeted value of ₹450000 higher than the existing ₹278737. Although the targeted value of the goal maximization of total production has been not fully achieved, it surpassed the existing production by 9 q. The optimal plan over-achieved the low priority goal with a negative deviation of ₹6999 from the targeted ₹29500.

Thus, in Marathwada, large farmers can fulfill their desire of high net return by reallocation of resources available with them in the form of land, labour, capital and feed & fodder from traditional cereal crops to commercial pulses and to crossbred cattle from local cows.

Effect of optimal resource use strategies on existing situation

It can be pursued that, almost in all the suggested optimum farm plans, cropping pattern shifting in favour

Table 4. Optimal plan for medium farming households

Enterprise	Land, animal allocation (acres)		Annual net returns (₹)		Total output (q)		Cost deviation (₹)	
	Existing	Observed	Existing	Observed	Existing	Observed	Existing	Observed
Tur	4.40	10.74	37904	91032	24.67	60.14	48703	24394
Soybean	4.96	0.00	19997	0	34.58	0.00		
Jowar	2.53	2.43	5950	4692	23.42	22.20		
Sugarcane	2.58	1.29	27981	16468	64.53*	40.01*		
Wheat	8.75	1.65	16693	3020	58.75	11.00		
Gram	3.14	11.55	33332	137525	20.00	73.54		
IC	1	0	5434	0	5.90	0.00		
CB	1	3	23421	67263	29.40	88.20		
B	1	0	9444	0	8.60	0.00		
Total	14.47, 3	14.47, 3	180156	320000	269.85	295.09		

production in 'tonnes'.

Table 5. Optimal plan for medium farming households

Enterprise	Land, animal allocation (acre)		Annual net returns (₹)		Total output (q)		Cost deviation (₹)	
	Existing	Observed	Existing	Observed	Existing	Observed	Existing	Observed
Tur	8.00	16.91	62216	130478	43.11	90.47	58954	22501
Soyabean	4.42	0.00	10453	0	24.50	0.00		
Jowar	4.98	2.85	10951	6413	43.94	25.30		
Sugarcane	9.13	6.75	79575	72603	227.00*	189.60*		
Wheat	11.40	3.02	26419	5587	75.58	20.01		
Gram	5.98	16.74	43686	178490	25.75	104.63		
IC	2	0	10744	0	12.00	0.00		
CB	1	2	21735	43470	31.50	62.00		
B	1	1	12960	12960	8.40	8.40		
Total	26.50, 4	26.50, 3	278738	450000	491.78	500.41		

production in 'tonnes'.

of pulses viz. Tur and Gram. Table 6 reflects the summary of the optimal plans brought change in existing values of annual net returns and total production of Tur and Gram. Close perusal of it revealed that the high priority goal of maximization of net returns has been either fully achieved or over-achieved than targeted rate preferred by farmers. During the setting of the target for maximum required net returns per annum, the items included were household expenditure on food consumption, medical services, education, family functions, cloths and repayment of annual installment of various loans that they may have. Through the implementation of optimal plans, landless farmers could increase their net income by 41 percent which was at par with their aspiration level. Similarly, marginal & small farmers could double their net returns by acquiring suggested farm plan as it shows 102 percent additional returns to that of actual. Medium category farmers could enhance their income by 78 percent which was above their target level. Sometimes large farmers may also be in financial crisis despite sizable land holding could make up high income by abolishing Soybean crop as suggested by the model in both regions.

Increase in net return caused two major factors. First, shifting of cropping pattern from high less remunerative Soybean crop to the favourable pulses like Tur and Gram with constant productivity among all crop enterprises. This cropping patterns help to increase production by about 2 to 3 fold than the existing production which later percolates in increased net returns. Second thing responsible for increased return was changing the composition of the herd. In all the farm plans, low productive animals were replaced by high productive animals, which also assist in increased milk production and thereby returns. Thus, it creates scope to upgrade the low productive local breeds in order to increase milk production.

However, the suggested farm plans considered constant prices of inputs and output in 2012-13. The allocation of resources to develop optimum farm plans is subject to change in input and output prices. The sensitivity analysis may further be carried out in various price changing scenarios.

Table 6. Increase in existing values of high priority goals given by optimum farm plans

(Percent)

Region	**Marathwada**	
Farming category	**Net return (G1)**	**Total production (Tur+Gram)**
Landless	41.16	
Marginal and small	102.61	144.48
Medium	77.62	199.70
Large	61.44	183.33

CONCLUSIONS AND POLICY IMPLICATIONS

Reallocation of resources from traditional less income-generating crops to relatively remunerative pulses Tur and Gram can be optimum to generate sufficient returns. The suggested optimum plan can have its positive impact on the returns of households only in presence of proper institutional arrangements. It involves the provision of quality inputs with affordable prices, strong price stabilization policies, improved and sufficient procurement facilities etc. In addition to this, marketing reforms should also have a primary consideration in this respect involving the authentic and timely provision of market information, weeding out of unnecessary intermediaries so that the real benefit should go to the cultivator himself, and not to the intermediaries, modern infrastructure facilities like storage and transportation etc.

Besides crop, dairy enterprise to has the substantial scope and potential to uplift distressed farming households. In order to promote dairy as a business, more resources should be allocated to high yielding animal species. In addition to this other livestock support services in the form of expansion and strengthening infrastructure for artificial insemination, facilitate genetic improvement of important native breeds through selective breeding, improvement of productivity of pasture lands through introduction of improved fodder varieties and development of wastelands for forage production, provision of animal health services, promotion of technological inventions for adding value to milk, provision of nutritious feed and fodder through promotion of fodder crops and fodder trees should be provided.

ACKNOWLEDGEMENTS

The authors wish to thank Dr. B. S. Chandel (Principal Scientist, NDRI) and Dr. A. K. Chauhan (Principal Scientist, NDRI) for their advice. Due acknowledgment is being paid to Department of Science and Technology, Government of India and NDRI for funding the research.

REFERENCES

Aromolaran, A.B., & Olayemi, J.K. (1999). Multiple objective farm planning for food crop farmers: A goal programming approach. *Discovery and Innovation, 11*(1 &2), 91-103.

Bulatovic, B. (1997). Choice of the livestock production system on family farms located in Northern Montenegro. *Review of Research Work at the Faculty of Agriculture*, Belgrade, *42*(2), 7-19.

Chand, R. (2017). *Doubling farmers' income: Rationale, strategies, prospects and action plan*. *NITI policy paper No. 1/2017*. Retrieved from http://niti.gov.in/writereaddata/files/document_publication/DOUBLINGpercent20FARMERSpercent20IN COME.pdf

Cohon, J.L. (1978). *Multi-objective programming and planning*. Mineola, New York: Dover Publication,

Department of Agriculture. *(n.d.) Agricultural census.* Department of Agriculture, Government of Maharashtra, Mumbai. Retrieved from *www.mahaagri.gov.in*

Harper, W.M., & Eastman, C. (1980). An evaluation of goal hierarchies for small farm operators. *American Journal of Agricultural Economics*, *62*(4), 742-747.

Lin W.T. (1980). A survey of goal programming applications. *Omega*, *8*(1), 115-117.

Pertiwi, S., Konaka, T., & Koike, M. (1992). Selection of alternative farm work plans by multi-criterion decision-making technique. *Japanese Journal of Farm Work Research*, *27*(1), 35-45.

Saha, A. (2003). *Economic evaluation of dairy farming systems in Haryana* (Doctoral Thesis). National Dairy Research Institute, Karnal.

Soon, K.B. (1983). A linear goal programming model for farm planning of semi-subsistence farms. *Journal of Rural Development*, *5,* 87-105.

Zeleny, M. (1982). *Multiple criteria decision making*. McGraw-Hil publication. The University of California.

Appendix 1. Optimum values of deviation variables

Goal	Landless		Marginal & small		Medium		Large	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual
G1	50000	51118	130000	130000	320000	320000	450000	450000
G2	60	70.10	125	118.75	350	295.09	575	500.41
G3	500	846	15100	12391.10	24350	24394.40	29500	22501.1
Deviations	d_1 0	d_1 1118	d_1 0	d_1 0	d_1 0	d_1 0	d_1 0	d_1 0
	d_2 0	d_2 10.1	d_2 6.25	d_2 0	d_2 54.91	d_2 0	d_2 74.59	d_2 0
	d_2 0	d_3 346	d_3 2708.90	d_3 0	d_3 0	d_3 44.40	d_3 6998.90	d_3 0

G1: Maximization of Net Return (₹/annum) G2: Maximization of Output (Qtls/annum).

G3: Minimization of Cost Deviation (₹/annum) d^- = negative deviation d^+ = positive deviation.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 41-45
DOI: 10.5958/2322-0430.2018.00033.1

NAAS Score: 4.82
www.naasindia.org
UGC Approved

An Economic Analysis of Bio-pesticides Use inPaddy Farms of Kerala[#]

Neethu Thomas[1], M. Thilagavathi[2], K.R. Ashok[2], and T.R. Raguchander[3]*

[1]*Technical Officer, Coconut Development Board, Pitapally P.O. Kumarabasta, Khurda-752055 (Orissa)*
[2]*Professor, Department of Agricultural Economics, and* [3]*Professor, Department of Plant Pathology*
Tamil Nadu Agricultural University, Coimbatore-641003

[*]*Corresponding author's email: neethu2382@gmail.com*

Received: December 29, 2017 *Manuscript Number: NS-18-52* *Revision Accepted: February 28, 2018*

ABSTRACT
This study highlighted the economic and environmental effects of biopesticides use in paddy farms of Kerala. The study has estimated the effect of biopesticide use in productivity of the crop, pesticide use and cost of cultivation of paddy & environmental benefits of biopesticide use. The ANOVA model, partial budgeting and Environmental Impact Quotient (EIQ) are the analytical tools used in this study. The farmers using biopesticide were getting higher yield with lesser cost of cultivation and lesser pesticide use. The lower EIQ value of the adopter farmers indicated the environmental benefits of pest management through bio-pesticides.

Keywords
Bio-pesticides, environmental benefits, environmental impact quotient.

JEL Codes
Q16, Q56.

INTRODUCTION

Green revolution is milestone in the history of agriculture. Over the last few decades, intensive and extensive cultivation of high yielding varieties of crops were introduced in India with a motive to increase food grain production resulted in fivefold increase in food grain production from 51 million tonnes during 1960's to 265.57 million tonnes in 2013-14. This agricultural transformation, popularly known as "Green revolution" had its impact on natural resources, environment, and biodiversity. Intensive cultivation, spread of high-yielding varieties, monoculture and overlapping of cropping seasons have resulted in high incidence of pests and diseases. Increasing crop loss due to pests and diseases had been major constraint in sustaining agricultural productivity and production. Pesticides are among the important agro-inputs to minimize the pest damages to crops and thereby minimize the yield losses and continued to pay a significant role in enhancing the agricultural production in India. India is the highest consumer of pesticides among the South Asian countries and it was estimated that in India pesticide consumption in 2013-14 was 54685 metric tonnes which was increasing at higher rate from 40672 metric tonnes during the year 2008-09. While the benefits of pesticide use in terms of preventing crop losses and increasing food grain production have been well recognized, its unwanted side effects on human health and environment have become a major concern (Lichtenberg, 2001).The indiscriminate pesticide led to several problems like pesticide residues in foodstuff, environmental pollution, imbalance of ecological equilibrium and resurgence of minor pests and pathogens.

The increased public concerns about the potential adverse environmental effects associated with the use of synthetic plant protection and production agrochemicals prompted search for the technologies and products based on biological processes to control the pests. Pesticide

[#]***This study is part of M.Sc. Thesis entitled "An Economic analysis of Bio pesticides use in Paddy farms of Kerala" of first author submitted to the Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, in 2015 under the guidance of second author, and funded by ICAR Junior Research Fellowship.***

residues in agricultural commodities are being the issue of major concern besides their harmful effect upon human life, wildlife and flora and fauna. Equally, worrying thing is about development of resistance in pest to pesticides. The only solution of all these is use of 'Biopesticides'.

Biopesticides are best alternatives to conventional pesticides and usually inherently less toxic than conventional pesticides. Benefits of biopesticides include effective control of insects, plant diseases, and weeds as well as human and environmental safety. Biopesticides play an important role in providing pest management tools in areas where pesticide resistance, niche markets, and environmental concerns limit the use of chemical pesticide products (Ranasingh, 2007).

Pesticide poisoning in Kerala has a long history. The State became the focus of interest and research in 1958 following the death of more than 100 people who had consumed wheat flour that had been contaminated with pesticides during transportation. Pesticides used in the food crops in the state include chemicals which are banned for sale in Kerala (Endosulfan), banned for use in fruits/vegetables (Monocrotophos) and those permitted for restricted use only (Methyl Parathion, Lindane,and Methoxy Ethyl Mercury Chloride). Many of the chemicals that are banned/not approved in many other countries and belong to the PAN Bad Actor Chemical group (Mancozeb, Carbendazim, Paraquat, Lambda Cyhalothrin, Diuron, quinalphos) were used by the farmers in Kerala state. In contrast to the national pattern, however, the fungicide use in Kerala is much higher (at 57 percent) when compared with the use of insecticides (Devi, 2007). More chemicals are used to protect crops in Kuttanad against the pest stem borer, brown planthopper, the rice bug and leaf folder. Spraying is done with a knapsack sprayer and is generally not supervised. Crucially, the dose of the spray fluid used is much higher than the recommended level.

There are so many health problems associated with the indiscriminate use of pesticides. Skin problems are the most common problem linked to pesticide use in Kuttanad, itching, eye-irritation and vision problems are also very common. The studies by volunteer groups revealed that increased incidences of cancer in the Kuttanadu region is attributed to the high chemical usage in the crop production. Taking all these issues into consideration the Government of Kerala is promoting the use of biopesticides in crop production. The State biocontrol lab, Mannuthy has supplied more than 90 tonnes of biopesticides in the state. Besides that, there are so many private suppliers, NGOs, KVKs and research stations are involving in the supply of biopesticides. As far as Kerala is concerned, coconut and rice are the major crops and Pseudomonas and Trichogramma are the major biopesticides used widely. These biopesticides are widely used in the production of Rice, Vegetables, Banana and Pepper also. The farmers awareness and adoption of biopesticides are yet to be motivated for maximizing gains. Hence, the present study has been undertaken 1) to find the impact of biopesticides on productivity, pesticide use, cost of cultivation and 2) to find its beneficial effect onenvironment.

DATA AND METHODOLOGY

The study was conducted in Alappuzha district of Kerala in 2015. Alappuzha district was purposively selected for the study as it is a major rice-growing area often referred as “Rice bowl of Kerala”. The primary data pertaining to agro-socio-economic variables were collected from farmers through a structured interview schedule. The relevant secondary data for the study, were collected from the records of the State Biocontrol Lab Mannuthy, Department of Economics and Statistics, Office of Principal Agricultural Officer Alappuzha, Agricultural Statistics, Panchayat Level Statistics, etc.,The sample respondents, that is, the farmers who applied Pseudomonas fluorescens and Tricho cards (adopters) and others (non-adopters were selected at random from the selected blocks of the study district. From the selected two villages in each block, 30 farmers were selected randomly from each village, comprising of 15 farmers each of adopters and non-adopters. Thus the total sample size was 120. The study has used ANOVA model and Environmental Impact Quotient (EIQ) for analysis.

Analytical Tools

Analysis of Variance (ANOVA) Model

The impact of biopesticide adoption on key variables like yield per ha and pesticide use were estimated through the following Analysis of Variance model. Since the independent variable, having binary value, adoption of biopesticides assumes values of 1 and 0, the most appropriate tool for analysis was ANOVA. The Yield of Paddy, Cost of Cultivation of Paddy and Expenditure on plant protection were considered as dependent variables.

Model was

$$Y = \alpha + \beta P + u \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(1)$$

Where,

Y=variable for which impact is estimated

P=1 for adoption of biopesticides

0 for non-adoption of biopesticides

This model estimated whether biopesticide adoption makes any significant difference in the yield, and pesticide use assuming that all other factors are held at constant. The intercept α gives the mean productivity of non-adopters and the slope β tells by how much the mean productivity of adopters, differs from the mean productivity of non-adopters. $\alpha+\beta$ gives the mean productivity of biopesticide adopters.

Environmental Impact Quotient (EIQ)

Kovach *et al.* (1992) developed Environmental Impact Quotient (EIQ) to measure environmental impact of different pesticides.EIQ value of individual pesticide refers to the average of its effect on farm worker, consumer, and environment.

EIQ={C[(DT*5)+(DT*P)]+[(C*((S+P)/2)*SY)+(L)

]+[(F*R)+(D*((S+P)/2)*3)+
(Z*P*3)+(B*P*5)]}/3

Where,

DT=dermal toxicity
C=chronic toxicity
SY=systemicity
F=fish toxicity
L=leaching potential
R=surface loss potential
D=bird toxicity
S=soil half life
Z=bee toxicity
B=beneficial arthropod toxicity
P=plant surface half-life

To account for different formulations of the same active ingredient and different use patterns,a simple equation called EIQ Field use rating was developed.

EIQ Field use rating=EIQ*percent of active ingredient*Rate of application of chemical

With this method, comparisons of environmental impact between pesticides and different pest management programmes can be made. In this study, the environmental benefits of biopesticide use were assessed using Environmental Impact Quotient Analysis.

RESULTS AND DISCUSSION

Natural enemy population in the field indicates the stability and health of the particular ecosystem. In the absence of natural enemies, the resurgence of pests will occur. It's obvious that the natural enemy population will be higher in the field where pesticide usage is less. The population of various natural enemies per acre is given in Table 1. From Table 1, it was clear that the natural enemy population was higher in the fields of bio-pesticide adopters than non-adopter paddy fields. The data on natural enemy population were obtained from farmers based on their observation. In the study area, chemical pesticides were used by all the non-adopter farmers and some of the adopter farmers. The adopter farmers were following chemical pesticide application in the recommended rate and the application is need-based. But the non-adopter farmers were applying chemical pesticides indiscriminately. The pesticide use pattern of the sample farmers is presented in Table 2. It was noticed that the usage of chemicals and number of farmers using chemicals seems to be very low in sample farms of adopter category. They were using Pseudomonas fluorescens (2.5kg/ha) and Trichocards (8 No./ha) which were stimulating the plant growth, reduces weeds and pest and disease incidences.

Table 1. Average natural enemy population in the sample paddy

(Numbers per acre)

Natural enemy	Adopters	Non-adopters
Beetles	22	12
Dragonflies	21	13
Mirid bugs	22	13
Spiders	20	14
Frogs	1.5	1.3

Impact of Bio-pesticides Use on Crop Yield, Cost of Cultivation and Pesticide Use

The effect of biopesticide use on crop yield, cost of cultivation and pesticide use were analyzed using ANOVA (Analysis of Variance)model. The farmers under the category of adopters in the study area were using Pseudomonas and Trichogramma for the management of pest and disease for the last 5 years. The qualitative variable, adoption level was taken as the independent

Table 2. Pesticide use pattern in sample farms

(Number)

Pesticides	Pesticide category	Units	Toxicity	Adopters		Non-adopters	
				Frequency	Application rate	Frequency	Application rate
Fame (Flubendiamide)	Diamide	ml/ha	Slightly	18	37.5	60	50
Acetaf	Organo phosphate	g/ha/	Slightly	20	500	60	1.25[@]
Bartriz (Cartap hydrochloride)	Nereis toxin analougue	kg/ha	Highly	6	10	60	20
Takumi (Flubendiamide)	Diamide	g/ha	Slightly	8	150	60	300
Chemidor (Imidacloprid)	Neonicotinoid	kg/ha	Moderate	4	4	60	10
Nominigold (Bis-pyribac	Pyrimidinyl Oxybenzoic	ml/ha	Highly	28	300m	60	300

@kg/ha

variable in ANOVA. Adoption level indicated whether the farmer was coming under adopter or non-adopter category.

Effect of Bio-pesticide Use on Yield of Paddy

In order to find out whether there is any significant difference in the paddy yield of farmers under adopter category and non-adopter category, the analysis tool used was ANOVA. Adoption level was taken as the independent variable and yield per hectare was taken as the dependent variable. The result is given in Table 3.

From Table 3, it was observed that the mean paddy yield for the farmers under adopter category was found to be higher than that of non-adopter farmers. The yield difference was statistically significant. The continuous adoption of bio-pesticides would have increased the soil quality and natural enemy population in the paddy farms.

Effect of Bio-pesticide Use on Cost of Paddy Cultivation

In order to find out whether there is any significant difference in the cost incurred in production of paddy for farmers under adopter category and non-adopter category, the analysis tool used was ANOVA. The adoption level of farmer was taken as independent variable and per hectare cost of production was taken as the dependent variable. It was done by running regression in usual manner and found out whether the coefficients differ significantly. The result is given in Table 4.

From Table 4, it was observed that the cost of cultivation was found to be lower for farmers under adopter category. The observed difference in cost of cultivation was found to be statistically significant. The farmers using bio-pesticides were using lesser quantity of chemical inputs like fertilizers and plant protection chemicals. The expenditure human labour was found to be less for farmers using bio-pesticides since they were following mechanization for most of the farm activities.

Effect of Bio-pesticide Adoption on Pesticide Use in Paddy Cultivation

In order to find out whether there is any significant difference in the pesticide use of farmers under adopter category and non-adopter category, the analysis tool used was ANOVA. The level of adoption was taken as independent variable and per hectare expenditure on pesticides was taken as dependent variable. The expenditure on pesticides was taken as the proxy for estimating pesticide use. The result is given in Table 5.

Table 5. Effect of bio-pesticide adoption on pesticide use in paddy cultivation

Variable	Expenditure on pesticides
Intercept (Cost of pest management for non-adopters)	4976.06
(Coefficient) difference in expenditure	-1631.56
Cost of pest control for adopters	3344.5
t-value	7.04***
P-value	0

**** Significant at one percent level.*

From the Table 5, it was observed that the expenditure on pesticides was found to be less for farmers using bio-pesticides in paddy farms than farmers following only chemical method of pest control. The difference in the expenditure on pesticide was found to be statistically significant. From the results of Analysis of Variance, it was clear that the adopter farmers were getting higher yield with lesser cost of cultivation.

Environmental Benefits of Bio-pesticides Use in Pest Management

Environmental benefits of bio-pesticide use were analyzed using EIQ (Environmental Impact Quotient). The EIQ values and Field use EIQ obtained are presented in Table 6, and Table 7.Since both the adopter as well as non-adopter farmers were using same chemicals but in different rates, Field Use EIQ value gives a better picture of environmental impact of pesticide usage.

Table 3. Effect of biopesticide use on yield of paddy

(kg/ha)

Variable	Intercept (Mean yield of non-adopters)	(Coefficient) yield difference	Mean yield of adopters	t value	P value
Yield	5870.60	321.50***	6192.10	3.13	0.002

**** indicates one percent level of significance*

Table 4.Effect of bio-pesticide use on cost of paddy cultivation

(₹/ha)

Variable	Intercept (cost of production for non adopters)	(Coefficient) cost difference	Cost of production for adopters	t value	P value
Cost of cultivation	44330.20	-4960.83***	39369.37	6.20	0.000

**** Significant at one1 percent level.*

Table 6. EIQ values for non-adopter farmers

Trade name	Unit	Active ingredient	% Active ingredient	Application rate	EIQ	Field use EIQ
Fame	ml/ha	Flubendiamide	48	50	19.4	0.4
Acetaf	kg/ha	Acephate	75	1.25	24.9	20.8
Bartriz	kg/ha	Cartap hydrochloride	4	20	47.2	16.8
Chemidor	kg/ha	Imidacloprid	10	10	36.7	32.8
Nominigold	ml/ha	Bis-pyribac sodium	10	300	11.5	0.3
Takumi	g/ha	Flubendiamide	20	300	19.4	1

Table 7. EIQ value for adopter farmers

Trade Name	Active ingredient	Units	Percent active ingredient	Application rate	EIQ	Field use EIQ
Fame	Flubendiamide	ml/ha	48	37.5	19.4	0.3
Acetaf	Acephate	g/ha	75	500	24.9	8.3
Nominigold	Bis-pyribac sodium	ml/ha	10	300	11.5	0.3
Bartriz	Cartap hydrochloride	kg/ha	4	20	47.2	16.8
Chemidor	Imidacloprid	kg/ha	10	10	36.7	32.8
Takumi	Flubendiamide	g/ha	20	150	19.4	0.5

From the Table 6 and 7, it was observed that Field use EIQ values were found to be higher for farmers under non-adopter category. It was because of the fact that the farmers coming under the non-adopter category were applying the Pesticide chemicals at higher rate than the adopter farmers. The sample farmers in adopter former category were using the chemicals in recommended rate only. The sample farmers under the adopter category in the study area were not following complete organic paddy production. They were also using plant protection chemicals only on need base. But the sample farmers under non-adopter farmer category were using plant protection chemicals at a rate higher than recommended. They had applied the pesticides in the sample farms 4 times on an average.

CONCLUSIONS

The study has highlighted the economic and environmental beneficial effects of bio-pesticides over chemical pesticides. The adopter farmers were getting higher yield with lesser cost of cultivation and lesser pesticide use. The lower EIQ value of the adopter farmers compared to that of non-adopters indicated the environmental benefits of pest management through bio-pesticides. The high EIQ values of the non-adopter farmers indicated the negative environmental impact of indiscriminate pesticide use. Since the chemical pesticides causes health problems to the human beings and destroys the quality of environment, the adoption of biological pest and disease management need to be promoted.

ACKNOWLEDGEMENTS

The authors are grateful to the anonymous referee for the valuable suggestions. The views expressed are those of the authors only.

REFERENCES

Devi, P.I. (2007). *Pesticide use in the rice bowl of Kerala: Health costs and policy options*. Working Paper No. 20, South Asian Network for Development and Environmental Economics, Kathmandu, Nepal

Kovach, J., Petzoldt, C., Degni, J., & Tette, J. (1992). *A method to measure environmental impact of pesticides.* New York Food and Life Sciences Bulletin, No.139, New York: State Agriculture Experiment Station, Cornell University.

Lichtenberg, E. (2001, August 5-8). Pesticide productivity in green revolution rice production: A case study of Vietnam. Presented at the *Annual Meeting of the American Agricultural Economics Association*, Chicago.

Ranasingh, N. (2007). Bio-pesticides:An economic approach for pest management. *Orissa Review,* 77-79. Retrieved from https://pdfs.semanticscholar.org/f410/9504a888f4823ad5ffa6b80786cae4b408f5.pdf

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 46-51
DOI: 10.5958/2322-0430.2018.00034.3

NAAS Score: 4.82
www.naasindia.org
UGC Approved

A Shift in Traditional Production System: A Case Study of Natural Rubber Cultivation in Tripura

Gaurav Sharma[1], N.M. Chauhan[1], and S.K. Dey[2]*

[1]*College of Polytechnic in Agriculture, Navsari Agriculture University, Vyara-394 650 (Gujarat)*
[2]*Regional Research Station, Rubber Research Institute of India, Agartala- 799 006, Tripura.*

[*]*Corresponding author's email: gaurav30688@gmail.com*

Received: December 30, 2017 *Manuscript Number: NS-18-53* *Revision Accepted: February 28, 2018*

ABSTRACT
In developing country like India where more than half of the population derives their livelihood from agriculture sector, sustainability of agriculture cannot be discussed in isolation to the issue related to livelihoods. In this background, the study has been conducted for examining the changing agricultural scenario of Tripura. The policy approaches has been found successful intransforming the starving economically and socially marginalized groups (ESMG) from Jhumia based cultivation to commercial cultivation of Natural Rubber (NR). Multistage probability proportion has been used for selection of 544 NR growers. The improved livelihood style of the NR growers has been reflected in terms of self-sustaining occupational shift. The maximum area of the surveyed household was previously barren land. The study has suggested for replication of the NR model in North and Dahalai district of Tripura. This successful model of Tripura could also be replicated in other regions of the country having similar socio-economic and agro-climatic conditions to ensure rural upliftment and livelihood security of the downtrodden.

Keywords
Jhum, land use pattern, livelihood security, natural rubber, sustainability, trends.

JEL Codes
C81, Q12, Q56.

INTRODUCTION

Tripura is third smallest state of India located in the North East, whose 84 percent boundary is encircled by Bangladesh. The state has varied topography, about 70 percent consists of hills and small hillocks the latter being called as *tilla*. The state being away from mainland lacks basic infrastructure of development. According to 2011 census, 73.8 percent of the population belong to rural section and primary sector contribute 26.96 percent of the Net State Domestic Product (Government of Tripura, 2015). Thus for the inclusive development of the state, it is mandatory to have innovation at grass root level. In this regard, various administered attempts were made to uplift the un-organized farmers. The literature reveals the first attempt was made in 1931 by late Maharaja Bir Bikram Kishor Manikya Bhadur when he implemented *Jhumia* Settlement Scheme. Thereafter many agricultural and horticultural based schemes by public sector agencies were implemented but none of the schemes were successful in delivering the desired results of social and economic upliftment of the rural poor (Bhattacharya, 1992). In 1963 Forest Department of Tripura planted Natural Rubber as a soil conservation measure and presently NR is the most viable industrial crop in Tripura cultivated by over 71370 ha (Rubber Board, 2014) small growers mostly tribals. Although the valuable contributions of NR to the regional economy are widely acknowledged (Joseph *et al.*, 2009, 2010, 2010a, 2012; Majumder *et al.,* 2014; Sharma *et al.,* 2011, 2013, 2014, 2014a), there has been an unsettled debate on the implications of the growing popularity of rubber based diversified farming systems. An important allegation is centered on the replacement of food crops by rubber and the increasing dependence of the landlocked state on food brought from outside the state. However, the allegations raised by various quarters are either based on the

convenient statistics or anecdotal evidences. Thus the present study is a concerted effort to study the trends in livelihood and land use pattern of Natural Rubber growers in Tripura. The specific objectives of the study were:

I. To study the trends in livelihood earning pattern of surveyed NR growers of Tripura,
ii. To examine the land use pattern of Natural Rubber growers in Tripura, and
iii. To access the factors for adoption of NR

MATERIAL AND METHODS

The present study was conducted in Tripura. Multistage probability proportion has been used for the selection of NR growers. At first stage, the all the 4 districts namely West, South, North and Dhalai were selected for the study. The second stage was formulated for selection of growers at grass root level. The study didn't include the growers covered under institutionalized plantation development schemes as the key objective of all these schemes was converting *Jhum* land into commercial plantation of NR. These institutional interventions have transformed around twenty-five thousand hectares of *Jhum* land to NR plantations. In third stage, the criteria for district wise selection was formulated. As more than three fourth of area under NR in the state is concentrated in the West and South districts, a sizable portion of sample is selected from these two districts. The remaining two districts (North Tripura and Dhalai) are in the initial phase of NR expansion, thus they were also selected for understanding the transition phase in expansion of NR. In all 544 NR growers were selected using multistage probability proportion for selection of 158, 261 and 125 NR growers from South Tripura, West Tripura and North-Dhalai district/ region respectively. The relevant primary data was collected by personal interview method during the period 2012-2015. Descriptive statistics was employed to analyze and interpret the data.

RESULTS AND DISCUSSION

Trends in Livelihood Earning Pattern

Livelihood earning pattern of NR cultivation

The results of the study showed that the rural economy of Tripura is predominantly agrarian. Table 1 show that 73.16 percent of the sample households lead their life as cultivators and agriculture was their primary source of livelihood. It provided employment to a majority of the working population of the region and gave them their primary identity. Within the districts of North Tripura and Dhalai half of the households were having agriculture as their primary occupation but the revealing fact is that around 17 percent of the households were found engaged as manual laborers. However, prior to inception of NR cultivation in the region, the livelihood of the rural population was mainly from manual labor. Although majority of the rural households were engaged in agriculture, the low returns from agriculture had forced the growers to look for alternative sources of income. A more elaborate discussion is provided in the next section.

Livelihood earning pattern prior to NR cultivation

The livelihood pattern of the growers prior to NR cultivation, presented in Table 2 reveals that the major occupation of the surveyed households was manual labor (44.49 percent) and only 16.54 percent were found primarily dependent on agriculture. Among the sample households, 13.97 percent had no regular employment. It is evident from the table that prior to NR cultivation, the rural economy of the state was incapable of providing sustainable sources of livelihood for the rural poor. As the state was land-locked, the rural masses had only few options available for a sustainable livelihood. Across the four districts covered, it was found that manual labor was

Table 1. Primary occupation of respondent household farmers

Primary occupation	District			Total
	South	West	North/ Dhalai	
Cultivator/Farmer	139 (87.98)	196 (75.10)	63 (50.40)	398 (73.16)
Labourer	6 (3.80)	10 (3.83)	21 (16.80)	37 (6.80)
Shopkeeper/ Businessman	5 (3.16)	23 (8.81)	6 (4.80)	34 (6.25)
Job	7 (4.43)	31 (11.88)	35 (28.00)	73 (13.42)
No clear arrangement	1 (0.63)	1 (0.38)	-	2 (0.37)
Total	158 (100)	261 (100)	125 (100)	544 (100)

Figures in parentheses are percent of the total.

Table 2. Primary occupation of respondent household prior to NR plantation

Primary	District			Total
	South	West	North/ Dhalai	
Cultivator/ Farmer	27 (17.09)	44 (16.86)	19 (15.20)	90 (16.54)
Labourer	88 (55.7)	116 (44.44)	38 (30.40)	242 (44.49)
Shopkeeper/ Businessman	11 (6.96)	49 (18.78)	6 (4.80)	66 (12.13)
Job	10 (6.33)	29 (11.11)	31 (24.80)	70 (12.87)
No clear arrangement	22 (13.92)	23 (8.81)	31 (24.80)	76 (13.97)
Total	158 (100)	261 (100)	125 (100)	544 (100)

Figures in parentheses are percent of the total.

the primary source of livelihood for majority of the households.

Natural Rubber cultivation has brought a huge shift in the livelihood pattern of the rural population. The primary occupation of rural community has shifted from manual labor to cultivation of NR (73.16 percent). According to study conducted by Joseph *et al.* (2010) in Tripura, NR cultivation has brought an overall increase of 112 percent in the income of the farmers in the region. Apparently, NR has brought about considerable socio-economic upliftment in the area. District/region-wise analysis of livelihood earning pattern revealed that the shift was higher in districts having more NR cultivation. The highest share of growers earning from manual labor in West and South Districts (45 and 56 percent) shifted to growers earning from cultivation (75 and 88 percent). But in two district(North/ Dhalai) where NR cultivation is inthe initial stages, the shift of livelihood is in a transition stage. The North/ Dhalai region currently has 50 percent households engaged in agriculture whereas prior to NR cultivation it was only 15 percent.

The underlying fact revealed by the two tables is that prior to NR cultivation the source of income in the rural economy of the state was characterized by uncertainty as majority of the households were laborers with fluctuating seasonal income. The subsistence agriculture followed in the area prior to introduction of NR failed to ensure sustainable livelihood to the rural community. With the introduction of NR in the state, the rural mass got a new option for income. The institutional interventions of the Rubber Board and the State Govt. has provided good infrastructure and marketing network enabling the NR farmers to fetch good price for their produce(Sharma *et al*., 2013).

According to FAO (2009, 2013), food security exists when all people, at all times have physical, social and economic access to sufficient, safe and nutritional food which meets their dietary need and food preferences for an active and healthy life. In the light of FAO description, NR cultivation in Tripurais instrumental in ensuring food security by enhanced economic access to food among the rural tribes by enhancing their income. The low return trap in the state's *Jhum* based agriculture has been revived with the introduction of NR.

Trends in Land Use Pattern

NR is being cultivated in Tripura since last five decades and improved the living standards of the local peasantry. But recently there has been an unsettled debate regarding encroachment of food crops area by NR and hence the land use pattern in the state and respondent households is discussed.

Agro-climate and topography of Tripura

Before going to discussion of land use pattern, it is essential to understand the topography of the state and impact of agro-climatic factors on it. Table 3 shows the profile of agro-climatic topography of the state. The state has varied topography and about 70 percent consists of hills and small hillocks, the latter being called as tilla. The altitude varies from 15 m to 940 m above sea level. Moreover, the state experiences a very high rainfall ranging up to 2500mm annually. Apparently, with high slope and rainfall duration for about 6 months, the agriculture in the area has to be developed in a precise manner to get good returns. The crops must be selected to withstand the adversities of the climate. The problem becomes more acute with the infrastructural bottlenecks. Even if a farmer sustains the adversity of climate in producing a crop he has to transport his produce to distant places like Guwahati to get better return (as the state has limited demand). In this backdrop NR got popularity because it can withstand in slopy tract of Tripura and its processed produce can be stored for a period of 6 months. With the marketing support of Rubber Board, TFDPC, TRPC and numerous dealers network, the growers receive comparatively better farm gate price (Sharma *et al*., 2014). Thus the popularity of NR in the state is based on its adaptability to the adverse climate and topography and also onthe institutional interventions/innovations to tackle the infrastructural bottlenecks.

Land use pattern of the state

The land use pattern/ area under major crops sown in Tripura showed that rice is the major crop in the state with about 2.6 lakh ha covering 53 percent of Gross cropped area (Table 4). The horticulture section specifically fruits and vegetables are the second most important sector within agriculture contributing 1.1 lakh ha (23 percent of

Table 3. Classification of agro-climatic topography in Tripura

Classification of terrain		Agro-climatic classification	
	Area (km^2)	Seasons	Months
High Area	4000	Winter	December- February
Tilla land with moderate steep slopes	1600	Pre-monsoon	March-April
Tilla land with gentle to moderate slope	700	Monsoon	May-September
Rolling Topography	2149	Post Monsoon	October-November
Plainland	2042	Total Annual rainfall	1500 mm to2500mm
Total geographical area	10491		

Source: www.agritripura.in.

Table 4. Area under major crops in Tripura

(ha)

Crops	2000-01	2005-06	2009-10	2014-15
Rice	241165	256078	244853	257273
Maize	1580	2150	1918	4519
Wheat	1065	2610	701	135
Pulses	10020	8544	6170	11664
Oilseeds	6260	3384	3422	6249
Sugarcane	1040	874	859	793
Cotton	910	1143	965	904
Vegetables	31300	25600	32500	39110
Fruits	28300	36500	36900	71180
Rubber	29737	36596	53769	70295

Source: Tripura statistical abstract, 2007; Tripura Economic Review 2011,2015 and National Horticulture Board handbook.

Table 5. Terrain used for NR cultivation by respondent household

Terrain	Terrain used by the respondent NR growers	Topographic classification of Tripura
Tilla land (Hillocks)	521 (96.00)	2.30 lakh (21.7 percent of total area)
Plainland	15 (3.00)	2.04 lakh ha (19.8 percent of total area)
Both	8 (1.00)	-
Total	544 (100.00)	

Figures in parentheses are percent of the total.

Gross cropped area). Although rubber ranks third in terms of area it provides a stable livelihood to around 50000 small growers in the state. The demand for crops like rice, fruits, and vegetable are stable as the demand for these items are based on the local market and the scope of increasing area under these food crops are limited due to the infrastructural bottlenecks. Moreover, raising these crops may ensure food security at the macro (state) level but the fortune of the poor farmers will depend on the returns received, which according to present trends is very low. Das *et al*. (2011) in their study in Tripura revealed that during peak season pineapple farmers in the state receive non-remunerative price affecting their livelihood. Thus in order to fetch a comfortable livelihood either infrastructure bottlenecks has to be removed or already successful crops like NR may be encouraged strategically as a tool of poverty alleviation and ensuring food security among the rural tribes.

Terrain use pattern by NR farmers

Farmers in the state preferred plain lands with irrigation facilities to cultivate food crops like rice, fruits, and vegetables, etc. and tilla land (hillocks) for cultivation of NR. As the tilla land lacks proper irrigation facilities, they are found uneconomical for cultivating food crops. NR being a perennial crop with well-developed tap root system can easily sustain in high rainfall zones where artificial irrigation is not possible. Thus with the passage of time a symbiotic structure has been developed in the state where food crops are cultivated in plain lands and NR in tilla lands. This point is well reflected in the survey results on the pattern of terrain use by the farmers in the state (Table 5). It was observed that 96 percent of the surveyed NR growers cultivated it on tilla land. Around 2.3 lakh ha tilla land is available in the state, giving a greater scope for further expansion of NR in the state.

Trends in land brought under NR cultivation

The results of the land use pattern of the surveyed NR cultivators, prior to shifting to NR, presented in Table 6 reveals that maximum area under the present NR plantations were previously barren land (66 percent), followed by bamboo cultivation (16 percent) and *Jhum* (11 percent). The shift to rubber from food crops like rice and fruits and vegetables was 0.55 and 3.13 percent respectively. Across different caste categories, it is revealed that majority of the present NR plantations were previously barren lands. For ST category the second highest category previous land use was *Jhum* (20 percent), while for all other categories it was bamboo cultivation (14 to 25 percent).

Reasons for Adoption of NR cultivation

The study also tries to understand the reasons/factors responsible for the shift in favor of NR cultivation. In order to understand the reasons for the transformation, the sample farm households were asked few specific questions on the factors which have encouraged them to take up NR cultivation. The factors as mentioned by the respondents are presented in Table 7.

It is evident from Table 7 that majority of the respondents (79.60 percent) shifted to NR cultivation for better income. While higher income was the prime motive for 45.40 percent of the respondents, 34.20 percent of the respondents shifted to rubber due to the demonstration effect, that is, having convinced of the better fortune realized by the fellow farmers from NR cultivation. Failure of other crops was cited as the reason for the shift by 13.20 percent of the respondents.

CONCLUSIONS

The study revealed the transformation of the agricultural sector of Tripura from a primitive *Jhum* based system to a highly commercial NR based system due to the better livelihood ensured by the crop and the requisite institutional interventions. Five decades ago Natural Rubber was introduced in Tripura as a soil conservation measure and presently it plays a key role for the sustainable livelihood and nutritional security of the rural economy. The study revealed that the rural economy has transformed from a labor based subsistence economy to a commercial plantation-based economy. The primary

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 46-51
DOI: 10.5958/2322-0430.2018.00034.3

NAAS Score: 4.82
www.naasindia.org
UGC Approved

A Shift in Traditional Production System: A Case Study of Natural Rubber Cultivation in Tripura

Gaurav Sharma[1], N.M. Chauhan[1], and S.K. Dey[2]*

[1]*College of Polytechnic in Agriculture, Navsari Agriculture University, Vyara-394 650 (Gujarat)*
[2]*Regional Research Station, Rubber Research Institute of India, Agartala- 799 006, Tripura.*

[*]*Corresponding author's email: gaurav30688@gmail.com*

Received: December 30, 2017 *Manuscript Number: NS-18-53* *Revision Accepted: February 28, 2018*

ABSTRACT
In developing country like India where more than half of the population derives their livelihood from agriculture sector, sustainability of agriculture cannot be discussed in isolation to the issue related to livelihoods. In this background, the study has been conducted for examining the changing agricultural scenario of Tripura. The policy approaches has been found successful intransforming the starving economically and socially marginalized groups (ESMG) from Jhumia based cultivation to commercial cultivation of Natural Rubber (NR). Multistage probability proportion has been used for selection of 544 NR growers. The improved livelihood style of the NR growers has been reflected in terms of self-sustaining occupational shift. The maximum area of the surveyed household was previously barren land. The study has suggested for replication of the NR model in North and Dahalai district of Tripura. This successful model of Tripura could also be replicated in other regions of the country having similar socio-economic and agro-climatic conditions to ensure rural upliftment and livelihood security of the downtrodden.

Keywords
Jhum, land use pattern, livelihood security, natural rubber, sustainability, trends.

JEL Codes
C81, Q12, Q56.

INTRODUCTION

Tripura is third smallest state of India located in the North East, whose 84 percent boundary is encircled by Bangladesh. The state has varied topography, about 70 percent consists of hills and small hillocks the latter being called as *tilla*. The state being away from mainland lacks basic infrastructure of development. According to 2011 census, 73.8 percent of the population belong to rural section and primary sector contribute 26.96 percent of the Net State Domestic Product (Government of Tripura, 2015). Thus for the inclusive development of the state, it is mandatory to have innovation at grass root level. In this regard, various administered attempts were made to uplift the un-organized farmers. The literature reveals the first attempt was made in 1931 by late Maharaja Bir Bikram Kishor Manikya Bhadur when he implemented *Jhumia* Settlement Scheme. Thereafter many agricultural and horticultural based schemes by public sector agencies were implemented but none of the schemes were successful in delivering the desired results of social and economic upliftment of the rural poor (Bhattacharya, 1992). In 1963 Forest Department of Tripura planted Natural Rubber as a soil conservation measure and presently NR is the most viable industrial crop in Tripura cultivated by over 71370 ha (Rubber Board, 2014) small growers mostly tribals. Although the valuable contributions of NR to the regional economy are widely acknowledged (Joseph *et al.*, 2009, 2010, 2010a, 2012; Majumder *et al.,* 2014; Sharma *et al.,* 2011, 2013, 2014, 2014a), there has been an unsettled debate on the implications of the growing popularity of rubber based diversified farming systems. An important allegation is centered on the replacement of food crops by rubber and the increasing dependence of the landlocked state on food brought from outside the state. However, the allegations raised by various quarters are either based on the

convenient statistics or anecdotal evidences. Thus the present study is a concerted effort to study the trends in livelihood and land use pattern of Natural Rubber growers in Tripura. The specific objectives of the study were:

I. To study the trends in livelihood earning pattern of surveyed NR growers of Tripura,
ii. To examine the land use pattern of Natural Rubber growers in Tripura, and
iii. To access the factors for adoption of NR

MATERIAL AND METHODS

The present study was conducted in Tripura. Multistage probability proportion has been used for the selection of NR growers. At first stage, the all the 4 districts namely West, South, North and Dhalai were selected for the study. The second stage was formulated for selection of growers at grass root level. The study didn't include the growers covered under institutionalized plantation development schemes as the key objective of all these schemes was converting *Jhum* land into commercial plantation of NR. These institutional interventions have transformed around twenty-five thousand hectares of *Jhum* land to NR plantations. In third stage, the criteria for district wise selection was formulated. As more than three fourth of area under NR in the state is concentrated in the West and South districts, a sizable portion of sample is selected from these two districts. The remaining two districts (North Tripura and Dhalai) are in the initial phase of NR expansion, thus they were also selected for understanding the transition phase in expansion of NR. In all 544 NR growers were selected using multistage probability proportion for selection of 158, 261 and 125 NR growers from South Tripura, West Tripura and North-Dhalai district/ region respectively. The relevant primary data was collected by personal interview method during the period 2012-2015. Descriptive statistics was employed to analyze and interpret the data.

RESULTS AND DISCUSSION

Trends in Livelihood Earning Pattern

Livelihood earning pattern of NR cultivation

The results of the study showed that the rural economy of Tripura is predominantly agrarian. Table 1 show that 73.16 percent of the sample households lead their life as cultivators and agriculture was their primary source of livelihood. It provided employment to a majority of the working population of the region and gave them their primary identity. Within the districts of North Tripura and Dhalai half of the households were having agriculture as their primary occupation but the revealing fact is that around 17 percent of the households were found engaged as manual laborers. However, prior to inception of NR cultivation in the region, the livelihood of the rural population was mainly from manual labor. Although majority of the rural households were engaged in agriculture, the low returns from agriculture had forced the growers to look for alternative sources of income. A more elaborate discussion is provided in the next section.

Livelihood earning pattern prior to NR cultivation

The livelihood pattern of the growers prior to NR cultivation, presented in Table 2 reveals that the major occupation of the surveyed households was manual labor (44.49 percent) and only 16.54 percent were found primarily dependent on agriculture. Among the sample households, 13.97 percent had no regular employment. It is evident from the table that prior to NR cultivation, the rural economy of the state was incapable of providing sustainable sources of livelihood for the rural poor. As the state was land-locked, the rural masses had only few options available for a sustainable livelihood. Across the four districts covered, it was found that manual labor was

Table 1. Primary occupation of respondent household farmers

Primary occupation	District			Total
	South	West	North/ Dhalai	
Cultivator/Farmer	139 (87.98)	196 (75.10)	63 (50.40)	398 (73.16)
Labourer	6 (3.80)	10 (3.83)	21 (16.80)	37 (6.80)
Shopkeeper/ Businessman	5 (3.16)	23 (8.81)	6 (4.80)	34 (6.25)
Job	7 (4.43)	31 (11.88)	35 (28.00)	73 (13.42)
No clear arrangement	1 (0.63)	1 (0.38)	-	2 (0.37)
Total	158 (100)	261 (100)	125 (100)	544 (100)

Figures in parentheses are percent of the total.

Table 2. Primary occupation of respondent household prior to NR plantation

Primary	District			Total
	South	West	North/ Dhalai	
Cultivator/ Farmer	27 (17.09)	44 (16.86)	19 (15.20)	90 (16.54)
Labourer	88 (55.7)	116 (44.44)	38 (30.40)	242 (44.49)
Shopkeeper/ Businessman	11 (6.96)	49 (18.78)	6 (4.80)	66 (12.13)
Job	10 (6.33)	29 (11.11)	31 (24.80)	70 (12.87)
No clear arrangement	22 (13.92)	23 (8.81)	31 (24.80)	76 (13.97)
Total	158 (100)	261 (100)	125 (100)	544 (100)

Figures in parentheses are percent of the total.

the primary source of livelihood for majority of the households.

Natural Rubber cultivation has brought a huge shift in the livelihood pattern of the rural population. The primary occupation of rural community has shifted from manual labor to cultivation of NR (73.16 percent). According to study conducted by Joseph *et al.* (2010) in Tripura, NR cultivation has brought an overall increase of 112 percent in the income of the farmers in the region. Apparently, NR has brought about considerable socio-economic upliftment in the area. District/region-wise analysis of livelihood earning pattern revealed that the shift was higher in districts having more NR cultivation. The highest share of growers earning from manual labor in West and South Districts (45 and 56 percent) shifted to growers earning from cultivation (75 and 88 percent). But in two district(North/ Dhalai) where NR cultivation is inthe initial stages, the shift of livelihood is in a transition stage. The North/ Dhalai region currently has 50 percent households engaged in agriculture whereas prior to NR cultivation it was only 15 percent.

The underlying fact revealed by the two tables is that prior to NR cultivation the source of income in the rural economy of the state was characterized by uncertainty as majority of the households were laborers with fluctuating seasonal income. The subsistence agriculture followed in the area prior to introduction of NR failed to ensure sustainable livelihood to the rural community. With the introduction of NR in the state, the rural mass got a new option for income. The institutional interventions of the Rubber Board and the State Govt. has provided good infrastructure and marketing network enabling the NR farmers to fetch good price for their produce(Sharma *et al*., 2013).

According to FAO (2009, 2013), food security exists when all people, at all times have physical, social and economic access to sufficient, safe and nutritional food which meets their dietary need and food preferences for an active and healthy life. In the light of FAO description, NR cultivation in Tripurais instrumental in ensuring food security by enhanced economic access to food among the rural tribes by enhancing their income. The low return trap in the state's *Jhum* based agriculture has been revived with the introduction of NR.

Trends in Land Use Pattern

NR is being cultivated in Tripura since last five decades and improved the living standards of the local peasantry. But recently there has been an unsettled debate regarding encroachment of food crops area by NR and hence the land use pattern in the state and respondent households is discussed.

Agro-climate and topography of Tripura

Before going to discussion of land use pattern, it is essential to understand the topography of the state and impact of agro-climatic factors on it. Table 3 shows the profile of agro-climatic topography of the state. The state has varied topography and about 70 percent consists of hills and small hillocks, the latter being called as tilla. The altitude varies from 15 m to 940 m above sea level. Moreover, the state experiences a very high rainfall ranging up to 2500mm annually. Apparently, with high slope and rainfall duration for about 6 months, the agriculture in the area has to be developed in a precise manner to get good returns. The crops must be selected to withstand the adversities of the climate. The problem becomes more acute with the infrastructural bottlenecks. Even if a farmer sustains the adversity of climate in producing a crop he has to transport his produce to distant places like Guwahati to get better return (as the state has limited demand). In this backdrop NR got popularity because it can withstand in slopy tract of Tripura and its processed produce can be stored for a period of 6 months. With the marketing support of Rubber Board, TFDPC, TRPC and numerous dealers network, the growers receive comparatively better farm gate price (Sharma *et al*., 2014). Thus the popularity of NR in the state is based on its adaptability to the adverse climate and topography and also onthe institutional interventions/innovations to tackle the infrastructural bottlenecks.

Land use pattern of the state

The land use pattern/ area under major crops sown in Tripura showed that rice is the major crop in the state with about 2.6 lakh ha covering 53 percent of Gross cropped area (Table 4). The horticulture section specifically fruits and vegetables are the second most important sector within agriculture contributing 1.1 lakh ha (23 percent of

Table 3. Classification of agro-climatic topography in Tripura

Classification of terrain		Agro-climatic classification	
	Area (km^2)	Seasons	Months
High Area	4000	Winter	December- February
Tilla land with moderate steep slopes	1600	Pre-monsoon	March-April
Tilla land with gentle to moderate slope	700	Monsoon	May-September
Rolling Topography	2149	Post Monsoon	October-November
Plainland	2042	Total Annual rainfall	1500 mm to2500mm
Total geographical area	10491		

Source: www.agritripura.in.

Table 4. Area under major crops in Tripura

(ha)

Crops	2000-01	2005-06	2009-10	2014-15
Rice	241165	256078	244853	257273
Maize	1580	2150	1918	4519
Wheat	1065	2610	701	135
Pulses	10020	8544	6170	11664
Oilseeds	6260	3384	3422	6249
Sugarcane	1040	874	859	793
Cotton	910	1143	965	904
Vegetables	31300	25600	32500	39110
Fruits	28300	36500	36900	71180
Rubber	29737	36596	53769	70295

Source: Tripura statistical abstract, 2007; Tripura Economic Review 2011,2015 and National Horticulture Board handbook.

Table 5. Terrain used for NR cultivation by respondent household

Terrain	Terrain used by the respondent NR growers	Topographic classification of Tripura
Tilla land (Hillocks)	521 (96.00)	2.30 lakh (21.7 percent of total area)
Plainland	15 (3.00)	2.04 lakh ha (19.8 percent of total area)
Both	8 (1.00)	-
Total	544 (100.00)	

Figures in parentheses are percent of the total.

Gross cropped area). Although rubber ranks third in terms of area it provides a stable livelihood to around 50000 small growers in the state. The demand for crops like rice, fruits, and vegetable are stable as the demand for these items are based on the local market and the scope of increasing area under these food crops are limited due to the infrastructural bottlenecks. Moreover, raising these crops may ensure food security at the macro (state) level but the fortune of the poor farmers will depend on the returns received, which according to present trends is very low. Das *et al*. (2011) in their study in Tripura revealed that during peak season pineapple farmers in the state receive non-remunerative price affecting their livelihood. Thus in order to fetch a comfortable livelihood either infrastructure bottlenecks has to be removed or already successful crops like NR may be encouraged strategically as a tool of poverty alleviation and ensuring food security among the rural tribes.

Terrain use pattern by NR farmers

Farmers in the state preferred plain lands with irrigation facilities to cultivate food crops like rice, fruits, and vegetables, etc. and tilla land (hillocks) for cultivation of NR. As the tilla land lacks proper irrigation facilities, they are found uneconomical for cultivating food crops. NR being a perennial crop with well-developed tap root system can easily sustain in high rainfall zones where artificial irrigation is not possible. Thus with the passage of time a symbiotic structure has been developed in the state where food crops are cultivated in plain lands and NR in tilla lands. This point is well reflected in the survey results on the pattern of terrain use by the farmers in the state (Table 5). It was observed that 96 percent of the surveyed NR growers cultivated it on tilla land. Around 2.3 lakh ha tilla land is available in the state, giving a greater scope for further expansion of NR in the state.

Trends in land brought under NR cultivation

The results of the land use pattern of the surveyed NR cultivators, prior to shifting to NR, presented in Table 6 reveals that maximum area under the present NR plantations were previously barren land (66 percent), followed by bamboo cultivation (16 percent) and *Jhum* (11 percent). The shift to rubber from food crops like rice and fruits and vegetables was 0.55 and 3.13 percent respectively. Across different caste categories, it is revealed that majority of the present NR plantations were previously barren lands. For ST category the second highest category previous land use was *Jhum* (20 percent), while for all other categories it was bamboo cultivation (14 to 25 percent).

Reasons for Adoption of NR cultivation

The study also tries to understand the reasons/factors responsible for the shift in favor of NR cultivation. In order to understand the reasons for the transformation, the sample farm households were asked few specific questions on the factors which have encouraged them to take up NR cultivation. The factors as mentioned by the respondents are presented in Table 7.

It is evident from Table 7 that majority of the respondents (79.60 percent) shifted to NR cultivation for better income. While higher income was the prime motive for 45.40 percent of the respondents, 34.20 percent of the respondents shifted to rubber due to the demonstration effect, that is, having convinced of the better fortune realized by the fellow farmers from NR cultivation. Failure of other crops was cited as the reason for the shift by 13.20 percent of the respondents.

CONCLUSIONS

The study revealed the transformation of the agricultural sector of Tripura from a primitive *Jhum* based system to a highly commercial NR based system due to the better livelihood ensured by the crop and the requisite institutional interventions. Five decades ago Natural Rubber was introduced in Tripura as a soil conservation measure and presently it plays a key role for the sustainable livelihood and nutritional security of the rural economy. The study revealed that the rural economy has transformed from a labor based subsistence economy to a commercial plantation-based economy. The primary

Table 6. Category of land brought under NR cultivation by the respondents

Barren land		General	OBC	SC	ST	Total	Percent
		96	73	75	116	360	66.18
Jhum cultivation		11	7	6	34	58	10.66
Food Crops	Rice	2	0	1	0	3	0.55
	F&V	9	3	2	3	17	3.13
Forest Trees/ Timber crop		3	1	2	5	11	2.02
Bamboo		20	28	24	17	89	16.36
Cotton		1	3	2	0	6	1.10
Total		142	115	112	175	544	100

Table 7. Reasons for adoption of NR cultivation by the respondents

Category	Good source of income	Failure of other crops	Income of fellow farmers	Others	Total
General	64	20	45	13	142
OBC	49	14	45	7	115
SC	58	14	29	11	112
ST	76	24	67	8	175
Total	247	72	186	39	544
Percent to total	45.40	13.20	34.20	7.20	100

occupation of the rural community has currently shifted to commercial agriculture (73.16 percent) while prior to introduction of NR the primary occupation of these growers was manual labor (44.49 percent). The results of previous land use pattern of the surveyed NR cultivators revealed that the maximum area under the present NR cultivation was previously barren land (66 percent), followed by bamboo (16 percent) and *Jhum* cultivation (11 percent).

Tripura is a landlocked state', for inclusive development of the state, it is mandatory to develop the primary sector of the state. The success story of NR shows the transformation of a primitive society to a commercial high-income group, which has multiple effects. In the present context, the two districts or zones of the state *i.e.*, West and South has adopted the NR to a large extent while NR cultivation in the other regions are still in the primitive stages. Hence, to extend the economic benefits of NR cultivation to the resource-poor rural farmers, it is important to encourage cultivation of the crop in the North and Dahalai regions also. This successful model of Tripura could also be replicated in other regions of the country having similar socio-economic and agro-climatic conditions to ensure rural upliftment and nutritional security of the downtrodden.

REFERENCES

Bhattacharya, S. (1992).*From Jhuming to tapping: Rubber plantation augurs well for the tribals of Tripura* (p. 85). Directorate of Research, Department of Welfare for Schedule Tribes, Government of Tripura.

Das, S.C., Prakash, J., Suresh, C.P., Das, A., & Bhattacharjee, T. (2011) Pineapple cultivation in hilly Tripura with year around production: Improving livelihood opportunities in rural areas of Tripura. *Acta Horticulturae*, *902*, 291-298.

FAO. (2009). *Declaration of the World Summit on Food Security* (p. 7).Rome: FAO.

FAO. (2013). *The state of food insecurity in the world 2013.The multiple dimensions of food security* (p. 56). Rome: FAO.

Government of Tripura. (2016). *Economic review of Tripura, 2014-15* (p. 296). Directorate of Economic and Statistics, Planning (Statistics) Department, Government of Tripura, Agartala.

Joseph, J., George, T.K., & Dey, S.K. (2009). Family labor shortage under rubber block plantation scheme in Tripura. *Rubber Board Bulletin*, *29* (4): 12-18.

Joseph, J., George, K.T., & Dey, S.K. (2010). *Report on the socio-economic impact of natural rubber cultivation under the block planting scheme in Tripura*. Rubber Research Institute of India, Kottayam. Retrieved from https://mpra.ub.uni-muenchen.de/52370/1/MPRA_paper_52370.pdf.

Joseph, J., George, T.K., & Dey, S.K. (2010a). *Report on the socio-economic impact of natural rubber cultivation under the block planting scheme in Tripura* (p. 39). Working Paper ER/4. Rubber Research Institute of India.

Joseph, J., George T.K., & Sharma, G. (2012). Institutional interventions, commercialization of agriculture and growth of infrastructural facilities: A case study of block planting units under natural rubber cultivation in Tripura. *Agricultural Economics Research Review*, 25 (Conf): 555.

Majumder, A.,Sharma, G., Rajeevan, B., Potti, M.N., Sen, S., & Devi, L.A. (2014, December 10-12). Knowledge management for capacitating the rural poor: Impact of

community processing cum technology transfer centres in the NR sector of Tripura. Paper presented in *International Symposium on Plantation Crops (Placrosym XXI) on Converging Technologies for Sustainability held at* ICAR-Indian Institute of Spices Research, Kozhikode, Kerala, India.

Rubber Board. (2014). *Indian rubber statistics*, *36*, 4. Rubber Board, Ministry of Commerce and Industry, Government of India, New Delhi.

Sharma, G., George T.K., & Dey, S.K. (2014). Natural rubber sector in Tripura: Role of institutional innovations. *Agricultural Economics Research Review*, *27*, 17-24

Sharma, G., George T.K., & Dey, S.K. (2014a). Marketing efficiency of natural rubber by organized and unorganized small growers in Tripura-An analysis. *Rubber Science*, ***27***(2), 225-233.

Sharma, G., George, T.K., Veeraputhran, S., Joseph J., & Dey, S.K. (2013). *A study on primary processing and marketing of natural rubber in Tripura* (p. 38). Rubber Research Institute of India. Discussion Paper Eco.3, Agartala: The Rubber Board.

Sharma, G., Joseph, J., George, T.K., & Dey, S.K. (2011). Impact of the Mahatma Gandhi National Rural Employment Guarantee Act on rubber block plantation scheme in Tripura. *Agricultural Economics Research Review*, *26*, 525-530.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 52-58
DOI: 10.5958/2322-0430.2018.00035.5

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Drip Irrigation System in Cotton Cultivation: One Step Enroute Intended for Sustainable Agriculture

Mandlik Jugal Amrutrao[1], Harshika Choudhary[2], Amita Maurya[2], Virendra Singh[1]*

[1]*Department of Agricultural Economics, College of Agriculture, Pantnagar, Uttarakhand*
[2]*Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, U.P.*

[*]*Corresponding author's email: harshika.bhu@gmail.com*

Received: December 30, 2017 *Manuscript Number: NS-18-58* *Revision Accepted: February 28, 2018*

ABSTRACT
Maharashtra is the leading cotton producing state of India with the area of 40 lakh ha under cotton cultivation and a production of 82 lakh ha. But it lags much behind in term of productivity (379 kg per ha), which is far below the national average productivity of 482 kg per ha. The present study was conducted in Jalgaon, the highest cotton producing and drip using district ofMaharashtra, with the objective to estimate the costs and returns faced by farmers in adoption and non-adoption of drip system. The results revealed that at aggregate level total cost of cotton cultivation at farms using drip irrigation method (Cost C_3) was estimated to be ₹66531 per ha whereas the same was estimated to be₹66355 per ha on farms using conventional irrigation method. Per hectare net returns over Cost C_3 at aggregate level of farms growing cotton with drip irrigation method were estimated to be ₹36509 per ha while the same, on the farms growing cotton with conventional irrigation method were estimated to be ₹26907 per ha.

Keywords
Conventional, cotton cultivation, drip, irrigation methods, Jalgaon district.

JEL Codes
Q12, Q15.

INTRODUCTION

Cotton, The White Gold and The King of Fiber enjoys a predominant position among the cash crops in India and plays a vital role in the country's economic growth by providing substantial employment and making significant contribution to export earnings. Cotton cultivation not only engages around 6 million farmers but also involves another about 40 to 50 million people relating to cotton cultivation, cotton trade and its processing. Since irrigation contributes substantially to the gross production of agriculture commodities, the rapid increase in demand for irrigation water puts enormous pressure on the policy makers to find out ways and means to improve the production of agricultural commodities while economizing irrigation water. The conventional irrigation method predominantly followed throughout the world for cultivation is flood irrigation. It is considered to be most inefficient method in terms of field application efficiency and eventually the overall water use efficiency; as it allows heavy losses of water through conveyance and distribution (Shreshta & Gopalakrishnan, 1993; Rosegrant & Meinzen-Dick, 1996; Rosegrant *et al.,* 2002; Postal *et al.,* 2001).

Drip irrigation method (DIM) is one of the technical measures introduced about two decades back to increase the water use efficiency in Indian agriculture. Under this method, water is delivered directly to the root zone of the crops using pipe network and emitters. This method is different from the conventional method; water is dispersed to the whole cropland, instead of dispensing exclusively to the crop. Besides saving water, drip irrigation method is capable of enhancing the productivity of crops that too at lower cost of cultivation (Narayanamoorthy, 2004; Dhawan, 2002). Drip irrigation system has the potential to increase the productivity of cotton and efficiently addressing the issue of water scarcity. Work has been conducted across research institutes testing and verifying this method on farmers'

field across the country to estimate costs of and returns from cotton cultivation under drip and conventional irrigation methods.

METHODOLOGY

The study was conducted in Jalgaon district of Maharashtra as it had the highest area under cotton as well as cotton area under drip irrigation. A three stages ampling technique was employed for construction of sampling plan of the study. The first stage of sampling plan was the selection of talukas from the selected district, followed by selection of villages from the selected talukas and selection of respondent farmers from the selected villages. In the first stage of sampling, two talukas namely Chopda and Erandol were selected randomly for further selection of villages from Jalgaon district. The second stage of sampling is the selection of villages from the selected talukas. For selection of villages a list of villages falling under Chopda and Erandol talukas where cotton under drip irrigation is extensively grown was prepared in consultation with the respective Assistant Development Officers (Agriculture). From the prepared lists of villages under the talukas, two villages were selected randomly.The four villages selected were Sundargadi, Virwade from chopda and Bhalgaon, Erandol from Erandol talukas. Over all a sample of 80 farmers (40 each famers growing cotton under drip and conventional irrigation methods) were drawn. It may be noted that, according to district agriculture office updates in Jalgaon district very few marginal and small farmers cultivate cotton under drip irrigation hence this study was focus on the medium and large farmers only to work out the net returns over various costs concepts adopted by the Commission for Agricultural Costs and Prices (CACP).

RESULTS AND DISCUSSION

Cost of and Return from Cotton under Drip and Conventional Irrigation Methods

Input use level of cotton growing farmers under drip and conventional irrigation methods

The pattern of input use in cotton cultivation is exhibited in Table 1 for medium, large and overall categories of farms following drip and conventional irrigation methods. It is the extent of input employment in cotton cultivation which ultimately decides the yield level and in turn profitability. The extent of input use no tonly depends upon the extent of input ownership but also on rationalization considered by them. The input use pattern differs among various categories of farmers in cotton cultivation under drip and conventional irrigation method. There are many inputs used in cultivation of cotton i.e. human labour, bullock labour, machine power, seed, irrigation water, manure and fertilizer etc. Table presents input use level of cotton growing farmers under drip and conventional irrigation method. Analysis of table indicates that the human labour employed by farmers growing cotton under drip irrigation method was 208.45 man days per ha, whereas the same was 238.97 man days per ha employed by farmers growing cotton under conventional irrigation method. Further in case of drip irrigation method, human labour was employed 232.32 man days per ha by medium sized farms while in case of their counterpart large sized farm was employed 192.01 man day per ha. In the same line conventional irrigation method, human labour was used 189.04 man days per ha by medium sized farms while the same was employed 264.86 man days per ha by large sized farms. The differences of human labour across farm categories may be due to differences in number of intercultural operation and number of picking in cotton cultivation. With regards to bullock labour, farmers growing cotton under drip irrigation method have employed 2.39 days per ha while 2.23 days per ha bullock labour was employed by farmers following conventional irrigation method. Again medium sized farms, bullocks labour was employed 2.89 day per ha on farms growing cotton under drip irrigation method, whereas the same was employed 2.04 day per ha by large sized farms using drip irrigation method. In the same line 2.70 days per ha and 1.89 days per ha bullock labour was employed by medium and large farms using conventional irrigation method for cotton cultivation, respectively. This slight difference may be attributed by number of hoeing and harrowing operations.

In respect to machine power, cotton growing farmers with drip irrigation method were employed 8.17 hr per ha while in case of their counterparts growing cotton under

Table 1. Input use levels of cotton growing farmers under drip and conventionalirrigation methods

(Inputs/ha)

Particulars	Drip irrigation method			Conventional irrigation methods		
	Medium	Large	Overall	Medium	Large	Overall
Human labour (man days)	232.32	192.01	208.45	189.04	264.86	238.97
Bullock labour (day's)	2.89	2.04	2.39	2.70	1.98	2.23
Machine power (Hr.)	6.75	9.15	8.17	9.52	9.72	9.65
Seed (kg)	1.08	1.14	1.12	1.46	1.35	1.39
Irrigation water (cm)	64.40	66.64	65.52	83.33	81.33	82.33
Manure (q)	30.82	59.11	47.57	51.86	15.63	27.99
Fertilizer* (kg)	503	382.50	413.50	398	386	390

**Fertilizer: Urea, DAP, SSP, Potash, 18:18:10 and 10:26:26.*

conventional irrigation method was employed 9.65 hrs per ha. In the case of cotton growing under drip irrigation method, machine power was employed 6.75 hr per ha and 9.15 hrs per ha by medium and large-sized farms, respectively, while same was employed 9.52 hr per ha and 9.72 hrs per ha by medium and large-sized farms growing cotton with conventional irrigation method, respectively. There was not any difference observed between large farmers following drip and conventional irrigation method but medium farmers using drip and conventional irrigation method have shown the difference.

The Table 1 further indicates that use of seed quantity by farmers growing cotton under drip irrigation method was found to be 1.12 kg per ha whereas it was used 1.39 kg per ha by farmers growing cotton under conventional irrigation method. In case cotton cultivation under drip irrigation method, seed quantity was used 1.08 kg per ha by medium-sized farms growing cotton while its counterpart large-sized farms were used1.14 kg per ha of seed quantity. In case of conventional irrigation method, seed quantity was used 1.46 kg per ha by medium-sized farm whereas the same was used 1.35 kg per ha by large-sized farms under conventional irrigation method. The differences in seed rate may be attributed to optimum spacing maintained under drip irrigation method for proper physiological growth of seedling, and less frequency of gap filling operations. In respect to irrigation water, farmers growing cotton under drip irrigation method was applied 65.52 cm per ha to cotton crop whereas it was applied 82.33 cm per ha by farmers growing cotton under conventional irrigation method.

With respect to manure, farmers growing cotton under drip irrigation method was used 47.57 q per ha while the same was used 27.99 q per ha by farmers growing cotton with conventional irrigation method. In case of drip irrigation method, medium and large-sized farms was used 30.82 q per ha and 59.11 q per ha of manure for cotton cultivation, respectively whereas the same were used 51.86 qp er ha and 15.63 q per ha of manure for cotton cultivation under conventional irrigation method, respectively. In case of fertilizer application, farmers growing cotton under drip irrigation method was used 413.50 kg per ha whereas the same was 390 kg per ha by farmers growing cotton under conventional irrigation method. In drip irrigation method, fertilizer was used 503 kg per ha by medium-sized farms while it was used 382.50 kg per ha by large-sized farms. In the same line farmers of conventional irrigation method,398 kg per ha and 385 kg per ha were used by medium and large-sized farms of conventional irrigation method.

Cost of Cotton Cultivation under Drip and Conventional Irrigation Methods

To find out profitability in cotton cultivation, the cost of cultivation and the returns over various costs were computed using CACP cost concepts for both drip and conventional irrigation method. The costs and returns were calculated for medium, large and overall farm categories and expressed in rupees per hectare. 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 costs is taken differently by different farmers. Some farmers are interested to know the returns over direct costs involved in the crop cultivation while the others are interested in considering the indirect costs as well such as the rental value of land and imputed value of owned labour. Therefore, it was considered worthwhile to work out the net returns over various cost concepts viz., cost A_1, A_2, B_1, B_2, C1, C_2, and C_3.Drip and conventional irrigation methods have been presented in Table 2. The cost of cultivation can be divided into different costs like operational cost, material cost, and other costs.

Operational cost: In the study area, cotton was grown during the kharif season. Labour is essential for weeding and sowing, fertilizer application, spraying, picking, etc. Due to scarcity of labour in peak period the wage of labour was varied for different intercultural practices, for this reason, the expenditure incurred on hired labour was high enough. Farmers growing cotton under drip irrigation method incurred on an average expenditure on the human labour of ₹23949 per ha while the expenditure on the human labour of ₹26733 per ha was made by farmers growing cotton with conventional irrigation method. In case of cotton grown with drip irrigation method, the medium and large farmers made on expenditure of ₹26342 per ha and ₹22225 per ha on human labour, respectively, while cotton grown with conventional irrigation method, medium and large farmers incurred ₹21696 per ha and ₹29343 per ha on human labour, respectively. The table further revealed that the expenditure on human labour made by farmers using drip irrigation method was estimated to be 36.16 percent of total expenditure (Cost C_3) while that of farmers using conventional irrigation method was estimated to be 40.16 percent of total expenditure (Cost C_3).The cotton growing farmers using drip irrigation method made an expenditure of ₹1795 per ha on bullock labour, while an expenditure of ₹1568 per ha was made on the same by farmers using conventional irrigation. In case of drip irrigation method, medium and large sized farmers incurred ₹2167 per ha and ₹1533 per ha, respectively on bullock labour. While the medium and large size farmers using conventional irrigation method made on the expenditure of ₹1878 per ha and ₹1408 per ha on bullock labour, respectively. An expenditure made on bullock labour was estimated to be 2.58 percent and 2.36 percent of total expenditure, respectively by farmers growing cotton with drip and conventional irrigation method. With regard to machine power, farmers growing cotton with drip irrigation

method incurred ₹4282 per ha while ₹5010 per ha was incurred by farmers using conventional irrigation method on the same. Among farmer using drip irrigation method medium and large farmers incurred ₹4369 per ha and₹4291 per ha, respectively, on machine power. The expenditure on machine power was estimated to be ₹5150 per ha and ₹4938 per ha by medium and large farmers using conventional irrigation method. The expenditure made on machine power as a proportion of total cost of cotton cultivation (Cost C_3) stood at 7.10 percent and 7.55 percent in case of farmers using drip and conventional irrigation methods, respectively. Per ha, the operational cost incurred on cotton cultivation by the farmers using drip irrigation (₹31773) was lower than using conventional irrigation method (₹34858) and as a percentage of total cost (Cost C_3), the same stood 48.49 percent and 52.41 percent, respectively.

Material cost: The expenditure made on material for cotton cultivation such as seeds, manure, fertilizer, plant protection chemicals and electricity charges for irrigation water constitutes the component of material cost. It is observed from the table that material cost incurred in the cultivation of cotton was estimated to be ₹15691 (23.78 percent of Cost C_3) and ₹14550 (21.27 percent of Cost C_3) per ha on cotton growing farms using drip and conventional irrigation methods, respectively.

Among the material inputs expenditure on, fertilizes was the most important item of material cost. The expenditure made on fertilizer was estimated to be ₹6092 (9.20percent of Cost C_3) per ha on farms using drip irrigation, whereas the same was estimated to be ₹4898 (7.16 percent of Cost C_3) per ha on farms using conventional irrigation method. The expenditure on seeds was estimated to be ₹2897 (4.39 percent of Cost C_3) and ₹3609 (5.44 percent of Cost C_3) by farmers using drip and conventional irrigation method, respectively. The expenditure made on seed varied from ₹2823 per ha to ₹2939 per ha by medium and large size farmers using drip irrigation method while ₹3809 per ha and ₹3505 per ha was incurred on seed by medium and large size farmers using conventional irrigation method.

Another cost: The third component of the cost of cotton cultivation was other costs. Other cost consisted of (1) rental value of land prevalent in the area (2) interest on working capital (3) depreciation on the farm assets used in the cultivation of cotton crop (4) interest on the value of farm assets and (5) land revenue. The rental value of land was an important item of another cost, which was estimated to be ₹8000 per ha for cotton for across all size groups. The depreciation charges were estimated to be ₹1539 per ha for farmers using drip irrigation method whereas only ₹996 per ha was estimated for the farmers using conventional irrigation method. The interest on the value of fixed capital assets was another important item of other costs and estimated to be ₹2259per ha for farmers growing cotton using drip irrigation method whereas the same was estimated to be ₹1532 per ha for farmers growing cotton using conventional irrigation method. The difference in depreciation charges and interest on the value of fixed capital assets may be attributed to the number of farm assets their value.

As perusal Table 3 indicates the cost concept wise cost of cotton cultivation using drip and conventional irrigation methods. Cost A_1 which is also called out of pocket expenses (cash expenses) was analyzed to be ₹48080 per ha on farms growing cotton using drip irrigation method and the same was estimated to be ₹48593 per ha on farms growing cotton using conventional irrigation method. In cotton growing using drip irrigation method, the magnitude of Cost A_1 on medium and large farms was ₹49681 and ₹46826 per ha, respectively, whereas in the case of conventional irrigation method Cost A_1 was found to be ₹47473 and ₹50209 per ha on medium and large farms, respectively. Cost B_1 and Cost B_2 were estimated to be ₹50698 and ₹58698per ha for cotton growing farmers using drip irrigation method while the same were ₹52341 and ₹58125 per ha for cotton growing farmers using conventional irrigation method. Cost C3 on per ha basis, considered to be the cost of cotton cultivation was estimated to be ₹66531 and ₹66355 for cotton growing farmers using drip and conventional irrigation methods, respectively. It can be concluded from the above analysis that overall cost of cotton cultivation (Cost C_3) using drip irrigation and conventional irrigation methods had no any difference, but across medium and large farmers using drip and conventional irrigation methods had a considerable difference in total cost of cotton cultivation. Cost C_2 and Cost C_{2*} were found to be the same for the medium and large farmer using drip and conventional irrigation methods.

The returns from cotton cultivation using drip and conventional irrigation methods and returns over various cost have been presented in Table 4. The table reveals that the yield of cotton on farms using drip irrigation method was23.99 q per ha whereas the same was found to be 20.39 q per ha on farms using conventional irrigation method. Cotton growing farmers using drip irrigation method was harvested 1.18 times more cotton as compared to the farmers using conventional irrigation method. It also revealed from that gross return (₹101460) from cotton cultivation by farmers using drip irrigation method was 1.16 times higher than that received by farmers using conventional irrigation method (₹87316). It is clear from the table that on an average cotton growing farmers using drip irrigation method were getting a net income of ₹36509 per ha over total cost (Cost C_3) whereas farmers growing cotton using conventional irrigation method were getting a net income of ₹20875 per ha. Cotton growing

Table 2. Cost of cotton cultivation under drip and conventional irrigation methods

(₹/ha)

Particulars	Drip irrigation method			Conventional irrigation methods		
	Medium	Large	Overall	Medium	Large	Overall
Operational cost						
Human labour						
Owned	1919	1661	1790	3002	1781	2198
	(2.84)	(2.56)	(2.68)	(4.70)	(2.63)	(3.34)
Hired	24423	20564	22179	18694	27562	24536
	(36.09)	(31.70)	(33.55)	(29.31)	(40.71)	(34.20)
Sub total	26342	22225	23949	21696	29343	26733
	(38.93)	(34.26)	(36.23)	(34.01)	(43.34)	(40.16)
Bullock labour						
Owned	537	1116	882	1089	1111	1103
	(0.73)	(1.72)	(1.32)	(1.70)	(1.64)	(1.65)
Hired	1630	417	913	789	297	465
	(2.16)	(0.64)	(1.26)	(1.23)	(0.43)	(0.70)
Sub-total	2167	1533	1795	1878	1408	1568
	(2.89)	(2.36)	(2.58)	(2.93)	(2.07)	(2.36)
Machine labour						
Owned	238	2183	1392	460	1371	1060
	(0.61)	(3.66)	(2.42)	(0.72)	(2.02)	(4.78)
Hired	4131	2108	2938	4690	3567	4042
	(6.73)	(3.25)	(4.68)	(7.35)	(5.26)	(5.97)
Sub-total	4369	4291	4282	5150	4938	5010
	(7.34)	(6.91)	(7.10)	(8.07)	(7.28)	(7.55)
Miscellaneous charge	1396	1902	1699	1989	1317	1546
	(2.06)	(2.93)	(2.58)	(3.12)	(1.94)	(2.34)
Sub-total	34274	29951	31773	30713	37006	34858
	(51.22)	(46.46)	(48.49)	(48.13)	(54.63)	(52.41)
Material costs						
Seed	2823	2939	2897	3809	3505	3609
	(4.17)	(4.53)	(4.39)	(5.98)	(5.17)	(5.44)
Manures	3082	5912	4767	5186	3345	3973
	(4.55)	(9.11)	(7.26)	(8.13)	(4.94)	(6.13)
Fertilizers	7248	5276	6092	5395	4401	4898
	(10.71)	(8.13)	(9.20)	(8.45)	(6.50)	(7.16)
Plant protection chemicals	1493	1608	1564	1324	1495	1437
	(2.21)	(2.47)	(2.37)	(2.07)	(2.20)	(2.16)
Electricity charges for irrigation	348	386	371	314	327	323
	(0.51)	(0.59)	(0.56)	(0.49)	(0.48)	(0.48)
Sub-total	14994	16121	15691	16028	13073	14550
	(22.15)	(24.83)	(23.78)	(25.12)	(19.29)	(21.27)
Other costs						
Interest on working capital	829	793	809	765	845	818
	(1.22)	(1.22)	(1.22)	(1.20)	(1.24)	(1.23)
Land revenue	37.50	37.50	37.50	37.50	37.50	37.50
	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)
Rental value of owned land	8000	8000	8000	8000	8000	8000
	(11.82)	(12.33)	(12.12)	(12.54)	(11.81)	(12.18)
Depreciation	1465	1585	1539	930	1030	996
	(2.16)	(2.44)	(2.33)	(1.45)	(1.52)	(1.50)
Interest on the value of fixed capital assets	1928	2480	2259	1506	1546	1532
	(2.85)	(3.82)	(3.43)	(2.36)	(2.28)	(2.31)
Sub-total	12260	12896	12660	11239	11459	11384
	(18.11)	(19.87)	(19.19)	(17.62)	(16.90)	(17.15)

Figures in parentheses indicate percentage of total cost (Cost C_3).

farmers using drip irrigation method were got 1.75 times more net income from cotton than farmers using conventional irrigation method. Again the unit cost of cotton production incurred by farmers following conventional irrigation method (₹3253 per quintal) was higher than the farmers using drip irrigation method (₹2762 per quintal). Farmers growing cotton under conventional irrigation method was invest 1.18 times more than farmers growing cotton under drip irrigation method. Thus it can be concluded from the table that

Table 3. Cost concept wise cost of cotton cultivation under drip and conventional irrigation methods

(₹/ ha)

Particulars	Drip irrigation method			Conventional irrigation method		
Cost of cultivation	**Medium**	**Large**	**Overall**	**Medium**	**Large**	**Overall**
Cost A_1	49681	46826	48080	45473	50209	48593
	(73.41)	(72.19)	(72.82)	(71.29)	(74.17)	(73.18)
Cost A_2	49681	46826	47990	45473	50209	48593
	(73.41)	(72.19)	(72.82)	(71.29)	(74.17)	(73.18)
Cost B_1	52488	49306	50698	53473	51754	52341
	(76.25)	(76.01)	(76.24)	(83.84)	(76.45)	(76.97)
Cost B_2	60488	57306	58698	54979	59755	58125
	(88.07)	(88.34)	(88.39)	(86.20)	(88.27)	(87.56)
Cost C_1	54407	50967	52468	56475	53536	54539
	(79.09)	(78.57)	(78.93)	(88.54)	(79.09)	(82.31)
Cost C_2	62407	58967	60483	57981	61536	60323
	(90.91)	(90.90)	(90.95)	(90.90)	(90.90)	(90.90)
Cost C_2*	62407	58967	60483	57981	61536	60323
	(90.91)	(90.90)	(90.95)	(90.90)	(90.90)	(90.90)
Cost C_3	68648	64864	66531	63780	67689	66355
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Figures in parentheses indicate percentage of total cost (Cost C_3).

Table 4. Returns from cotton cultivation using drip and conventional irrigation methods

Particulars	Drip irrigation method			Conventional irrigation method		
	Medium	**Large**	**Overall**	**Medium**	**Large**	**Overall**
Yield of main product (qt per ha)	23.93	23.95	23.99	19.74	20.73	20.39
Yield of by product (q per ha)	30.57	30.44	30.55	25.76	26.40	26.07
Average price of main product (₹ per q)	4247	4235	4240	4215	4250	4238
Average price of by product (₹Per q)	30.5	30.5	30.5	30.5	30.5	30.5
Return from main product (₹per ha)	101631	101447	101448	83204	88103	86431
Return from By product (₹per ha)	932	928	931	786	805	798
Gross return (₹per ha)	102563	102375	102643	83990	88908	87316
Net Return (₹per ha) over						
Cost A_1	52883	55549	54563	38157	38699	38514
Cost A_2	52883	55549	54563	38157	38699	38514
Cost B_1	50955	53069	52304	30519	37153	34889
Cost B_2	42955	45069	44289	29011	29153	29106
Cost C_1	49036	51408	50535	27514	35372	32690
Cost C_2	41036	43408	42520	26008	27372	26907
Cost C_2*	41036	43408	42520	26008	27372	26907
Cost C_3	34883	37512	36509	20210	21219	20875
Net return (₹per ha)	34883	37512	36509	20210	21219	20875
Cost of production at cost C_3 (₹per q)	2828	2708	2762	3231	3265	3253
Gross return per Cost C_3	1.52	1.58	1.56	1.32	1.31	1.31

cotton cultivation under drip irrigation method was more profitable than cotton cultivation under conventional irrigation method because per quintal cost of production for cotton cultivation under drip irrigation method was low in comparison to cotton cultivation under conventional irrigation method.

REFERENCES

Dhawan, B.D. (2002). *Technological change in Indian irrigated agriculture: A study of water saving methods.* New Delhi: Commonwealth Publishers.

Narayanamoorthy, A. (2004). Drip irrigation in India: Can it solve water scarcity? *Water Policy*, *6*(2), 117-130.

Postal, S., Polak, P., Gonzales, F., & Keller, J. (2001). Drip irrigation for small farmers: A new initiative to alleviate hunger and poverty. *Water International, 26*(1), 3-13.

Rosegrant, W.M., Cai, X., & Cline, S.A. (2002). *World water and food to 2020: Dealing with scarcity*. International Food Policy Research Institute, Washington, D.C., U.S.A. and International Water Management Institute, Colombo, Sri Lanka.

Rosegrant, W.M., & Meinzen-Dick, R.S. (1996). Water resources in the Asia-Pacific region: Managing scarcity. *Asian-Pacific Economic Literature, 10(*2), 32-53.

Shreshta, R.B., & Gopalakrishnan C. (1993). Adoption and diffusion of drip irrigation technology: An econometric analysis. *Economic Development and Cultural Change, 41*(2), 407-418.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 59-63
DOI: 10.5958/2322-0430.2018.00036.7

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Effect of Liberalization on Growth and Instability in Area Production and Yield of Major Cereal Crops in Maharashtra

V.D. Waiwal, A.V. Gavali and D.B. Yadav*

Department of Agricultural Economics, Mahatma Phule Krishi Vidyapeeth, Rahuri-413722 District Ahmednagar

Corresponding author's email: vijay.waiwal@gmail.com

Received: December 30, 2017 *Manuscript Number: NS-18-59* *Revision Accepted: February 18, 2018*

ABSTRACT

The growth in agricultural production along with low instability is highly desirable. The objective of this study was to investigate effect of liberalization on growth and instability in area, production and yield of major cereal crops in Maharashtra. The finding of the study revealed positive and encouraging trends for maize and paddy among the cereals for area and production. The yield trend for all cereals except paddy was positive and significant. In Maharashtra, the area, production, and productivity of major cereals crops indicated that relatively lower instability in Post-WTO period than Pre-WTO period. The instability indices were higher for production due to area instability.

Keywords

Cuddy-Della Valle index, growth, instability, major cereals area, production, yield.

JEL Codes

F13, F68, O44, P32, Q18.

INTRODUCTION

Maharashtra is considered one of the heterogeneous states in Indian Union as far as the varying agro-climatic conditions are concerned. The state comprised Konkan, Western Maharashtra, Marathwada and Vidarbha regions. Gross cropped area of the State increased from 188.23 to 231.16 lakh hectares during last fifty-six years. The crop production in the State is mainly dependent on weather conditions, availability of inputs, nature of production technology and economic environment. The important cereals growing in the state are paddy, wheat, *kharif* jowar, *rabi* jowar, bajra, and maize. The total area under major cereals was decreased from 105.34 lakh ha to 76.67 lakh ha with increased production of 56.04lakhtonnes to 68.96 lakh tonnes in 1960-61 to 2015-16, but the growth in area and production largely varies from crop to crop and region to region of the state indicating instability in production in the state.

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. It is generally argued that instability in agriculture production has increased due to technological progress in agriculture. However, studies proved that instability in agriculture production has decreased due to expansion of modern technology. Pal (1986) found that variability in foodgrains production increased with the adoption of modern technology. On the other hand, Singh & Byerlee (1990) concluded that wheat yield variability decreased with the expansion of modern technology across country. Deshmukh (2007) concluded that study estimates not only growth in area, production, and yield of major cereals but also estimates its measure of instability in Maharashtra. In the backdrop of the main objective of the paper was to examine the growth and instability in area, production and yield of major cereal crops in Maharashtra.

METHODOLOGY

This study is based on time series data related to area, production and productivity of major selected cereal crops *viz;* paddy, wheat, *kharif* jowar, *rabi* jowar, bajra

and maize from the year 1975-76 to 2012-13. Data have been collected from the publications of Government/Non-Governmental Organizations such as Epitome, District Statistical Abstracts, Agriculture Statistics at a Glance etc. The time span is further divided into three periods, that is, from Period-I: 1975-76 to 1993-94, which is Pre-liberalization period and where agriculture sector was not liberalized, from 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 cereal crops and the Overall Period:1975-76 to 2012-13.

Growth rates of area, production and productivity for each cereal crops have been estimated by the following regression;

$Y=a.b^t$

Where,

Y= Area, production and productivity of selected crops.

t= Time variable in years

a=Intercept

b=Regression coefficient.

The instability index is estimated by using the Cuddy-Della Valle index(Cuddy-Della Valle index, 1978);

$$CD = (CV^*)(1-R^2)^{1/2}$$

Where, CD is the Cuddy-Della Valle index of instability; CV* is coefficient of variation without trend-adjusted data, and R^2 is coefficient of multiple determination from a time trend regression adjusted by the number of degrees of freedom.

The central Government policy is to reduce the restrictions on the external tread is the main feature associated with liberalization that started in the 1st January 1995. The free tread policy contributed considerable to agricultural growth in the state.

RESULTS AND DISCUSSION

The perusal of Table 1 revealed that during Period-I, the growth rate in area under wheat declined significantly by 1.65, 3.29 and 5.10 percent whereas productivity increased significantly in Western Maharashtra, Marathwada and Vidarbha region in the state. Among the major crops, the highest significant growth in the area of maize (5.57, 6.99, and 4.15 percent) per annum was noticed in these regions. The pre-liberalization Period-I (1975-76 to 1993-94) was characterized by increase in production of almost all the crops in the all the regions either significantly or non-significantly except, paddy (3.67 percent) and wheat (1.63 percent) in Marathwada, wheat (3.36 percent) and rabi jowar (2.40 percent) in Vidarbha region in the state. This happens only due to declined area under these crops in the respective regions.

The productivity of major cereal crops except, *Kharif* jowar in Western Maharashtra region; paddy and *Kharif* jowar in Marathwada region; and *Kharif* jowar in Vidarbha region showed negative compound growth rates increased in Period-II. Whereas declining significantly area under major cereal crops except, paddy in Western Maharashtra region; wheat in Marathwada region; and wheat and maize in Vidarbha region showed positive compound growth rates (Table 2).

During the overall period, growth rates in the case of area, production and productivity of maize in Western Maharashtra, Marathwada and Vidarbha region increased significantly in the state. On the other hand, the production has witnessed stagnation or declining trend of major cereal crops in all the regions of the state (Table 3). It might be due to decrease in area under crops.

The growth rates in area of bajra and maize, production of *kharif* jowar, bajra and maize and productivity of wheat, *kharif* jowar and bajra increased significantly during Period-I, The growth rates in area, production and productivity of wheat and maize increased significantly during post-liberalization period indicating the positive effect of liberalization and agricultural developmental schemes (Table 4). The growth rates in the case of productivities of all the major cereal crops increased significantly with different magnitudes in the state during the same period. At the overall period, growth rates in the case of production of almost all the crops except. *Kharif* jowar increased significantly. It is clearly indicated that the production of these crops were increased by both area expansion and productivity improvement in the state. whereas growth rates in area, production, and productivity of maize (7.06, 9.06 and

Table 1. Region-wise compound growth rates of area, production and productivity of major cereal crops in Maharashtra (Period-I 1975-76 to 1993-94)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Paddy	0.30	1.47*	1.17***	0.52***	0.1	-0.41	0.30	-3.67**	-3.95**	1.10	0.86	-0.24
Wheat	--	--	--	-1.65***	0.27	1.96***	-3.29***	-1.63	1.71**	-5.10***	-3.36***	1.84**
Kharif jowar	--	--	--	-0.27	0.95	1.23*	0.75	2.23	1.46	-1.39***	1.71*	3.14***
Rabi jowar	--	--	--	0.39	1.62*	1.22	-0.16	0.75	0.91	-3.69***	-2.4***	1.34*
Bajra	--	--	--	0.54	3.88***	3.33**	2.24***	7.0***	4.7***	-0.73	1.42	2.17*
Maize	--	--	--	5.57***	4.16**	-1.34	6.99***	4.61	-2.23	4.15***	4.03	-0.11

******, ** and ** Significant at 1, 5 and 10 percent level, respectively.***

Table 2. Region-wise compound growth rates of area, production and productivity of major cereal crops in Maharashtra (Period-II 1994-95 to 2012-13)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Paddy	-0.32 ***	0.38	0.70	0.5 ***	0.73	0.23	-12.5 ***	-16.64	-4.73***	-0.86*	-0.61	0.25
Wheat	--	--	--	0.50	1.93	1.59 ***	1.13	2.62 *	1.64**	2.51**	5.16**	2.15 *
Kharif jowar	--	--	--	-4.12 ***	-4.98 ***	-0.07	-5.46 ***	-6.08 ***	-0.66	-8.31***	-8.85***	-0.6
Rabi jowar	--	--	--	-1.31 **	-1.01	0.70	-0.88 **	0.64	1.42	-11.16***	-6.94***	3.81***
Bajra	--	--	--	-4.43 ***	-3.27 ***	1.21	-3.6 ***	-2.25*	1.40*	-11.45***	-11.15***	0.34
Maize	--	--	--	5.4 **	8.99 ***	3.4 ***	-2.66	-0.32	2.41	2.67	6.71**	3.93***

******, ** and ** Significant at 1, 5 and 10 percent level, respectively.***

Table 3. Region-wise compound growth rates of area, production and productivity of major cereal crops in Maharashtra (Overall period 1975-76 to 2012-13)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Paddy	-0.35***	0.92***	1.27***	0.23***	0.48***	0.24	-3.65***	-6.89***	-3.37***	-0.73***	-0.46	0.25
Wheat	--	--	--	-0.26	2.02***	2.09***	-0.99***	0.95**	1.83***	-1.43***	0.34	1.92***
Kharif jowar	--	--	--	-3.05***	-2.15***	0.73***	-2.93***	-2.00***	0.95**	-5.11***	-4.03***	1.13***
Rabi jowar	--	--	--	-0.46***	0.15	0.68*	-0.56***	0.44	1.05***	-6.75***	-5.22***	1.08***
Bajra	--	--	--	-1.7***	0.83	2.57***	-0.50*	2.42***	2.93***	-5.55***	-4.03***	1.6***
Maize	--	--	--	6.68***	8.4***	1.61***	7.28***	9.62***	2.18***	7.38***	10.53***	2.94***

******, ** and ** Significant at 1, 5 and 10 percent level, respectively.***

Table 4. Period-wise compound growth rates of area, production and productivity of major cereal crops in Maharashtra

Crops	Period-I (1975-76 to 1993-94)			Period-II (1994-95 to 2012-13)			Overall (1975-76 to 2012-13)		
	A	P	Y	A	P	Y	A	P	Y
Paddy	0.66	0.72	0.06	-0.72***	0.01	0.73	-0.57***	0.18	0.76***
Wheat	-3.11***	-1.2	1.97***	1.26	2.96**	1.68**	-0.78**	1.26***	2.06***
Kharif jowar	-0.39	1.63*	2.04**	-6.03***	-6.44***	-0.44	-3.74***	-2.85***	0.93***
Rabi jowar	-0.04	1.09	1.12	-1.39***	-0.71	0.69	-0.72***	0.04	0.76**
Bajra	0.90**	4.59***	3.65***	-4.26***	-3.06***	1.26*	-1.44***	1.19**	2.67***
Maize	6.05***	4.79**	-1.18	2.58	6.06*	3.39***	7.06***	9.06***	1.87***

******, ** and ** Significant at 1, 5 and 10 percent level, respectively.***

1.87 percent), per annum, increased significantly and negative but significant growth rates were observed in the case of area under paddy (0.57 percent), wheat (0.78 percent), *Kharif* jowar (3.74 percent), Rabi jowar (0.72 percent) and bajra (1.44 percent), respectively (Table 4).

The performance of this measure of dispersion during Period-I indicated that paddy stood first (2.90 percent) in least instability in Western Maharashtra, whereas maize exhibited greatest (50.23 percent) instability in Marathwada region. The Instability indices in production indicated that paddy stood first in least instability (9.19 percent) in Konkan region whereas maize exhibited greatest (111.20 percent) instability in Marathwada region. The highest instability in production of maize might be due to greater production of maize over a shorter period and also greater instability in area under maize. Instability indices regarding productivity of major cereal crops revealed that least instability was observed in paddy (8.45 percent) in Konkan region while the greater instability in maize in Marathwada region as compared to other regions of the state (Table 5).

During the Period-II, maximum instability was expressed by area under maize (55.44 percent) in Vidarbha region and as usual, paddy occupied first position in least instability among the regions and crops in the state. The increased instability in area under major cereals was observed in the post-liberalization period over pre-liberalization period. Instability in production of

wheat, *Rabi* jowar and maize in Western Maharashtra, paddy wheat and maize in Marathwada and wheat and maize in Vidarbha regions showed highest instability. The instability index for productivity of maize was 28.90 percent, which was highest as compared to other crops. Among the crops and regions, the lowest instability was observed in paddy (9.52 percent) in Western Maharashtra (Table 6).

The least instability was observed in area under paddy (3.40 percent) while the highest instability in the case of maize (60.31 percent) during the overall period (1975-2013). It might be due to greater area under crop over a shorter period. Among the cereals and regions, instability measure regarding production of major cereal crops revealed that least instability in the case of paddy (10.46 percent) in Konkan while the greater instability in the case of maize (79.64 percent)in Marathwada. It might be due to greater production under crop over a shorter period (Table 7).

The area instability indices of major cereal crops during Period-I indicated that *Kharif* jowar stood first in low instability (6.61 percent) whereas maize exhibited high instability (23.30 percent). During the Period-II, high instability was showed by area under maize (52.04 percent) and as usual, paddy occupied first position in low instability (4.52 percent). The high instability in area

Table 5. Region-wise Cuddy-Della Valle instability indices in area, production and productivity of major cereal crops in Maharashtra (Period-I 1975-76 to 1993-94)

(Percent)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Paddy	9.71	9.19	8.45	2.90	10.96	10.80	15.60	33.63	32.10	13.22	25.37	19.44
Wheat	--	--	--	6.60	16.96	15.14	15.04	20.27	16.39	11.77	18.93	15.62
Kharif jowar	--	--	--	5.56	16.19	15.62	15.09	30.92	33.09	3.04	22.32	21.61
Rabi jowar	--	--	--	8.14	20.21	20.81	13.20	17.37	20.89	10.73	17.40	16.11
Bajra	--	--	--	7.97	31.78	28.88	8.21	23.90	28.01	15.13	31.60	27.79
Maize	--	--	--	17.23	37.38	23.34	50.23	111.2	42.08	44.53	99.51	41.27

Table 6. Region-wise Cuddy-Della Valle instability indices in area, production and productivity of major cereal crops in Maharashtra (Period-II 1994-95 to 2012-13)

(Percent)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Paddy	1.22	9.82	9.92	3.03	10.15	9.52	24.95	31.07	21.57	9.88	25.94	22.35
Wheat	--	--	--	23.19	31.97	11.82	20.06	32.23	15.80	25.79	41.34	20.69
Kharif jowar	--	--	--	10.73	25.04	13.62	5.66	16.58	14.03	9.51	17.64	16.36
Rabi jowar	--	--	--	10.21	31.23	24.93	7.65	23.81	19.52	15.87	27.41	25.87
Bajra	--	--	--	12.4	22.57	19.67	11.58	24.00	17.60	14.10	21.49	23.79
Maize	--	--	--	54.63	70.19	19.16	43.79	65.76	28.90	55.44	76.11	28.43

Table 7. Region-wise Cuddy-Della Valle instability indices in area, production and productivity of major cereal crops in Maharashtra (Overall 1975-76 to 2012-13)

(Percent)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Paddy	7.70	10.46	9.60	3.40	10.65	10.37	31.52	48.55	39.18	14.31	25.90	21.07
Wheat	--	--	--	17.84	26.61	12.94	21.56	29.22	16.31	28.18	41.74	19.56
Kharif jowar	--	--	--	13.23	21.08	14.69	19.02	33.33	24.04	16.46	29.57	20.54
Rabi jowar	--	--	--	10.02	26.89	23.36	11.15	20.26	20.34	19.77	23.13	25.62
Bajra	--	--	--	15.09	33.02	22.56	17.68	31.88	21.49	24.46	37.98	25.15
Maize	--	--	--	43.46	65.61	25.33	60.31	79.64	37.75	50.52	75.17	36.96

Table 8. Cuddy-Della Valle instability indices in area, production and productivity of major cereal crops in Maharashtra

(Percent)

Crops	Period-I (1975-76 to 1993-94)			Period-II (1994-95 to 2012-13)			Overall (1975-76 to 2012-13)		
	A	P	Y	A	P	Y	A	P	Y
Paddy	9.36	13.09	11.14	4.52	12.26	10.58	9.22	12.72	11.26
Wheat	8.94	16.94	14.82	20.48	30.71	13.26	19.36	29.95	13.72
Kharif jowar	6.61	20.41	21.92	6.37	12.72	10.72	14.74	25.55	17.12
Rabi jowar	8.73	16.47	18.22	8.26	25.95	22.53	9.05	22.08	20.91
Bajra	7.52	28.42	26.92	11.07	19.81	17.23	15.05	30.97	20.48
Maize	23.30	55.29	25.23	52.04	70.45	20.01	45.40	64.23	26.47

under maize was mainly due increasing area over shorter period (Table 8). Instability in production of major crops shows that low instability in the case of paddy (12.72 percent) while the high instability in the case of maize (64.23 percent). The instability in production of wheat, *Rabi* jowar and maize has increased during Post-Liberalization period.

CONCLUSIONS

In conclusions, the analysis revealed that the highest instability was noticed in area of maize, while the least instability in area and production of paddy in Western Maharashtra region. In Marathwada and Vidarbha region highest instability was observed in the case of area and production of maize. The extent of instability was 30 percent in Maharashtra state except Konkan region. Thus, highest instability was due to more year to year variation in area under highest instability crops and less instability was due to less year to year variation in area under least instability crops.

REFERENCES

Deshmukh, R.G. (2007). *Growth and instability of major crops in Maharashtra inter-regional analysis* (Doctoral Thesis). Dr. P.D.K.V., Akola (MS).

Pal, S. (1986). *Instability in agriculture production in India* (Doctoral Thesis). Division of Agricultural Economics. Indian Agricultural Research Institute, New Delhi.

Singh, A.J., & Byerlee, D. (1990). Relative variability in wheat yields across countries and over time. *Journal of Agricultural Economics*, *41*(1), 21-32.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 64-70
DOI: 10.5958/2322-0430.2018.00037.9

NAAS Score: 4.82
www.naasindia.org
UGC Approved

A Study of Sustainable Livelihood Security in Eastern Uttar Pradesh

Amita Maurya[1], V. Kamalvanshi[2], C. Sen[3] and P.S. Badal[3]*

Research Scholar[1], Assistant Professor [2], Professor [3] Department of Agricultural Economics
Institute of Agricultural Science, Banaras Hindu University, Varanasi-221 005 (Uttar Pradesh)

[*]Corresponding author's email: amitamaurya28@gmail.com

Received: December 31, 2017 *Manuscript Number: NS-18-68* *Revision Accepted: February 28, 2018*

ABSTRACT

The concept of Sustainable Livelihood Security (SLS) has a wider generic meaning, encompassing current concerns and policy requirements pertaining to sustainable development. Keeping in view the changing social, economic and climatic environment, the issue of SLS becomes even more important for the farm sector. Agricultural diversification is viewed as a potential tool for SLS. The present study has been conducted in the Uttar Pradesh state of India to evaluate the status of SLS These have created a threat to ecological balance and economic as well as social status in different districts of the state. Secondary and cross-sectional data were used for the study. The study of Ecological Security Index (ESI), Economic Efficiency Index (EEI) and Social Equity Index (SEI) has revealed that the agricultural systems of all districts display wide variations in their ecological and social equity aspects relative to their economic aspects. The districts with better SLSI ranks are often described as advanced districts and vice versa. Hence, SLSI has been found to reflect the picture of the overall performance of a district in three dimensions of sustainability. On the basis of the overall performance of districts in terms of their SLSI, twelve districts in the state have an index value of more than 0.5, while only five districts have SLSI less than 0.4.

Keywords
Ecological security index, economic efficiency index, social security index, sustainable livelihood security.

JEL Codes
Q01, Q56.

INTRODUCTION

Sustainable livelihood is a manner of thinking about the intent, opportunity, and priorities for development, in order to magnify betterment in poverty elimination. The concept of sustainable livelihood security (SLS) has a wider collective meaning, encompassing present concerns and policy requirements involving to sustainable development (SD). Swaminathan (1991) has stated SLS as livelihood alternative that is ecologically secure, economically efficient, and socially equitable. Saleth & Swaminathan (1993); Saleth (1993) have identified 14 prime dimensions of sustainable agriculture covering social, economic, technological, political and environmental components of sustainability. Chambers & Conway (1992) suggested the concept of rural livelihood security (RLS) to focus on: capability, equity, and sustainability. Since the idea shows the protection or assurance of the means of livelihood for the masses not only at the present time but also in the future, it reflects equally the concern for both the inter-generational and the intra-generational equity. The concept of SLS has both macro- and micro-level involvement. While it is possible to manage distress migration mainly by decreasing regional imbalances of economic development, resource degradation, and social exploitation can be minimized only through equitable distribution, asset ownership, and access to natural and technological resources. At the same time, ecological security needs to be ensured for the sustenance of economic growth. Since SLS aims to provide the means for meeting the basic needs of humans, it is more sustainable as a policy tool than as a strategy aimed at the mere provision of basic needs. Ensuring SLS by enabling people to meet their own needs will lead to reduced pressure on the environment, which, in turn, means that it will be possible for more people to meet their livelihood needs in the future (Chambers, 1986). Uttar Pradesh is the most populous state in India. It is situated in northern part of India and shares the boundary with

Uttarakhand, Bihar Madhya Pradesh, Rajasthan, Haryana, Delhi, Himachal Pradesh, and an international boundary with Nepal. Uttar Pradesh is currently the fifth largest state of India covering nearly 7.32 percent of the total geographical area of the country (www.indiastat.com). The state is presently divided into 75 administrative districts and has 9 agro-climatic zones. There are 27 districts comes under eastern Uttar Pradesh. Agriculture in Uttar Pradesh is covering country's 11.44 percent of available land. There is vast variation in rainfall ranging from 600 mm to 1200 mm in different districts of the state. It has wide regional disparities and lags behind in several dimensions of human development, particularly in female literacy, enrolment, and retention of children in school, infant mortality, low per capita expenditure on health etc. Some districts are lagging behind in socio-economic terms. These districts have low foodgrain productivity, the higher level of poverty, low female literacy etc. These have created a threat to ecological balance and economic as well as the social status of households in different districts of the state. In the present study, a suitable method has been evolved for generating Sustainable Livelihood Security Index (SLSI) for agricultural sustainability and evaluating the existing status. Some measures have also been suggested to promote sustainable agriculture in Uttar Pradesh.

METHODOLOGY

The SLSI methodology is a generalization of relative approach underlying the Human Development Index, developed by the United Nations Development Programme (UNDP, 1992). It is a cross-sectional measure to evaluate the relative sustainability status of a given set of entities The Sustainable Livelihood Security Index (SLSI) was proposed by Swaminathan (1991)to serve as an educational as well as policymaking tool to evaluate the potential of sustainable development (SD).

Selection of Variables for Livelihood Sustainability

Due to variations in biophysical and socioeconomic conditions, indicators used in one region are not necessarily applicable to the other regions. For instance, fifteen variables have been selected to illustrate the three dimensions of SDA.

Ecological security index represented by variables such as the proportion of geographical area under forest cover (percent), cropping intensity (percent), livestock density (per sq. km), population density (per sq. km) and annual rainfall (mm), etc. Effective utilization of human resources and improvement in the overall quality of life of households are important for the sustainable development. If the people are healthy, educated and adequately skilled, they can participate fully and contribute more to the economic development process. Thus, the variable population density was selected in view of its capacity to reflect the extent of human pressure on the overall ecological security. Forests play a vital role in maintaining ecological balance and contribute significantly to the state economy. Cropping intensity is one of the indices of the level of SDA. It measures the extent of land-use for cropping purposes during a given year. Due to development of irrigation facilities, more areas have been brought under cultivation and farming communities could raise more than one crop on the same land in the same year. Livestock sector plays an important role in the socio-economic development of a nation by contributing significantly to not only value-added products in agriculture and allied sector but also providing employment, incomes and nutritional security to both urban and rural households. Rainfall is very important ecological variable for crop production that's why this variable was also taken into consideration.

Economic efficiency index represented by variables such as total food grain yield (kg/ha), milk yield per animal (kg/day), irrigation intensity (percent),fertilizer consumption(kg/ha) and per capita income (₹). Cereals and pulses are the main food, cultivated widely in Uttar Pradesh. It covers around 78 percent of the total gross cropped area. The yield rate of food grain is influenced directly or indirectly by the soil fertility, climate, irrigation, technologies and market performance. However, it has the potential to bias the evaluation in favor high-value cash crops of the districts. So the variable yield rate of food grain was selected to assess the economic efficiency of agricultural sustainability. The variable per capita output of food grain has the potential to food security status when it is contrasted with the critical minimum per capita grain availability (180 kg/capita/ annum) suggested by Brown (1981). Optimum use of fertilizer at the opportune time is an essential ingredient for increasing agricultural productivity. It also protects land fertility by meeting the nutrition requirement of crops. Per capita income has a vital role in the process of national development. It also reflects the picture of the overall standard of living, economic strength, and prosperity. Milk yield is also a variable of the economic component which positively affects the economy so this variable was also included in economic efficiency index.

Social equity index represented by variables such as male literacy rate (percent), female literacy rate (percent), infant mortality rate (percent), rural road connectivity (km.) and village electrified (No.). Male and Female literacy rate plays a vital role in the process development of nation especially female literacy rate plays an important role in women empowerment and national development. It shows the potential not only for women's social and economic participation but for population stabilization also. The chosen variable 'infant mortality rate' reflects the picture of health awareness and availability of facilities in the society. 'Rural road connectivity' is a crucial element of rural infrastructure scenario. Poor road connectivity is the important facet of backwardness of the region. Overall, it is a significant step to address the important issue of rural infrastructure required for economic growth. Village electrification scenario in the state continues to be a matter of concern.

Lack of reliable electricity supply dampens the growth impulses in different sectors of the economy. It is an essential pre-requisite of social equity for achieving overall sustainable agricultural development. Despite variations and limitations, the selected variables do have a good capacity to reflect the picture of overall ecological, economic and equity aspects of a district's agricultural systems. The secondary sources of data and general information for the fifteen potential variables for all the districts of Uttar Pradesh were obtained from Sakhyiki Patrika, Uttar Pradesh in 2016.

$$I_{ijk} = \frac{X_{ijk} - \min X_{ijk}}{\max X_{ijk} - \min X_{ijk}} \qquad \text{eq.(a)}$$

$$I_{ijk} = \frac{\max X_{ijk} - X_{ijk}}{\max X_{ijk} - \min X_{ijk}} \qquad \text{eq.(b)}$$

$$I_{jk}\ (ESI/\ EEI/\ SEI) = \sum I_{ijk} / n$$

$$LSI_k = \sum I_{jk} / 3$$

Eq. (a) was applicable to variables having positive implications for SLS and for all variables under each component Eq.(a) was applied except for one variable that was infant mortality rate and population density for which Eq (b) was applied as it has the negative implication on sustainable livelihood security. The numerators in equation (a) measure the extent by which the kth district did better in the ith variable representing the jth component of its SLSI as compared to the region showing the worst performance. The denominator is actually the range i.e. the difference between the maximum and minimum values of a given variable across districts, which is a simple statistical measure of total variation evinced by that variable. The denominator, in fact, serves as a scale or measuring rod by which the performance of each region is evaluated for a given variable.

Where

i = Variables (1, 2,…. ,n)

j = Components (1, 2 & 3)

k = Districts (1, 2,…….., K)

I_{ijk} = Index value of ith variable of jth component of kth district (i = 1; 2,. . ., n variables)

I_{jk} = Index value of jth component of kth district(j = 1 to 3 components)

$SLSI_k$ = Sustainable livelihood security index of kth district (k = 1,2,……..75 district)

X_{ijk} = The value of the ith variable representing the jth component of the kth district)

The value of index ranges from 0 to 1.

All the four indices (Ecological Security Index, Economic Efficiency Index, Social Equity Index and Sustainable Livelihood Security Index) have been classified into four categories viz. low status (index value less than 0.25), moderate status (index value from 0.25 to 0.5), high status (index value more than 0.5 to 0.75) and very high status (index value more than 0.75).

RESULTS AND DISCUSSION

The perusal of Tables 3 depicts that SLSI value ranged from 0.23 to 0.61. The results indicated that there was a significant variation between SLSI values. The tables further revealed that no one district has a 'very high' or 'low' status of sustainable livelihood security. Twelve districts out of 27 districts are found under 'high' status and 15 districts under 'moderate' status of sustainable livelihood security. The districts performed better in SLSI Gorakhpur(1 rank), followed by Azamgarh (2 rank) , Mau(3 rank), Sultanpur (4 ranks) and Faizabad (5 ranks). Gorakhpur district performance was very good in all three indices, the performance of Azamgarh was quite good in SEI as compared to ESI and EEI, but in case of Mau, its performance was not very good in SEI as compared to ESI and EEI. The poor performing districts in SLSI are Shravasti (27 ranks), followed by Balrampur (26 rank), Kaushambi (25 rank) and Bhadohi (24 rank). Shravasti and Balrampur have the least SLSI value because of the low value in EEI and SEI. Kaushambi have low ESI and SEI as compared to EEI. Most of the districts fall under moderate status in all indices. Twenty four districts were found belonging under the moderate status of ecological security, seventeen districts were found belonging under the moderate status of economic efficiency and only eleven districts came under moderate status in social security. In the context of an inter-district comparison of component indices (ESI, EEI, SEI), Maharajganj district dominated in ecological security in the eastern Uttar Pradesh, followed by Chandauli and Behraich. The worst performing districts in ecological security were Basti, followed by Kaushambi and Ballia. The better performing districts in economic efficiency were Faizabad, followed by Kushinagar and Varanasi. Similarly, bottom list districts in economic efficiency were Shravasti, Balrampur, and Sonebhadra. In the case of social equity aspects, the districts which performed better were Allahabad, Azamgarh, and Jaunpur. On the other hand, the districts which performed worst in social equity were Shravasti, Balrampur, and Behraich. The overall performance of the districts in terms of their SLSI revealed that twelve districts out of 27 districts in eastern Uttar Pradesh (nearly 1/2) had an index of SLSI above 0.5, while only five districts had SLSI value lower than 0.4. It has been reported by Bharti & Sen (1997) that in the overall performance of several districts of Bihar in terms of their Relative Sustainable Livelihood Security Index (SLSI), only about one-fourth of the 40 districts had SLSI of above 0.5 and about half of the total districts had SLSI lower than 0.4. Thus, most of the districts of south Bihar had a better agricultural sustainability in comparison to the districts of north Bihar, in general. In another study Hatai & Sen (2008) it was studied that only eight districts out of 30 districts in Orissa (about 1/4th) had an index of SLSI above 0.5, while thirteen districts had SLSI* value

Table 1. Ecological, economic and equity variables selected for agricultural sustainability in Uttar Pradesh

Districts	Ecology					Economic					Social Equity				
	Forest area (percent)	Cropping intensity (percent)	Population density (per sq. km)	Rainfall (mm)	Livestock population density	Total foodgrain yield (m.tonne)	Milk yield per animal (kg/day)	Irrigation intensity (percent)	Fertilizer consumption (kg/ha)	Per capita income (₹)	Male literacy rate (percent)	Female literacy rate (percent)	Infant mortality rate (Per 1000 child)	Village electrified	Rural road connect-ivity (km)
Pratapgarh	0.15	167.27	854	851.8	444.00	540692	3.84	91.26	140.5	22,309	81.9	58.4	88	1960	4945
Allahabad	3.85	153.57	1087	808.7	566.30	698903	4.11	83.21	140	35,365	82.6	61	88	2809	8697
Behraich	14.08	170.38	664	993.8	478.06	949492	3.70	39.92	151.7	24,285	58.3	39.2	66	1377	3210
Gonda	3.17	156.84	857	1027.2	469.33	739387	3.81	88.09	179.1	25,837	69.4	47.1	72	1678	3902
Faizabad	1.26	157.83	1054	989.7	644.67	448694	4.66	91.11	180.9	33,999	78.1	59	98	1160	3177
Sulatanpur	0.23	160.84	855	840.7	598.07	445638	3.79	85.34	167.2	35,493	81.5	59.5	48	1708	3753
Siddarth Nagar	1.24	150.24	882	1009.9	438.08	833989	4.85	89.51	147.6	22,601	70.9	47.4	91	1906	2737
Maharajganj	17.3	182.97	903	1214.1	405.34	783870	4.99	49.10	152.9	23,381	75.8	48.9	87	1128	3203
Basti	1.57	132.55	916	943.6	358.66	454157	4.82	92.64	190.4	25,959	77.9	56.2	84	2273	3366
Gorakhpur	1.78	155.09	1336	1175.5	530.63	682587	5.12	69.49	150.1	30,685	81.8	59.4	61	2472	4312
Deoria	0.1	163.95	1220	950.9	453.52	570005	4.96	91.05	151.8	23,470	83.3	59.4	75	1569	3436
Mau	0.32	167.85	1287	1004.7	629.46	357046	4.86	97.07	156.7	27,260	82.5	63.7	76	1365	2608
Azamgarh	0.02	167.63	1139	952.7	607.15	933828	4.82	94.74	160.8	20,472	81.3	60.9	79	3412	5891
Jaunpur	0.06	169.14	1108	874.1	543.56	863014	4.14	83.18	157.9	21,276	83.8	59.8	78	2413	6567
Ballia	0.02	159.45	1081	827.2	407.74	645048	4.80	81.00	155.5	24,575	83.8	59.8	72	1695	3258
Ghazipur	0.03	164.31	1073	883	592.29	717895	4.42	89.23	145.9	24,884	82.8	60.3	82	1681	5585
Varanasi	0.03	164.91	2399	923.5	820.31	271668	4.58	83.91	164.6	34964	83.8	66.7	78	911	3001
Mirzapur	24.14	141.57	566	901.1	484.36	470952	3.71	71.03	134.1	27,454	78.9	56.9	83	1745	4635
Sonebhadra	47.83	126.6	270	916.9	288.80	776234	3.63	26.17	146	33,870	74.9	52.1	62	1178	8273
Bhadohi	0.1	141.19	1531	846.1	772.73	158804	3.85	80.84	140.4	26577	81.5	56	80	627	1525
Kushinagar	0.28	149.46	1226	1158.4	476.38	454379	5.10	88.88	193.8	21,270	77.7	52.4	83	1506	3892
Ambedkarnagar	0.13	167.86	1021	904.8	516.16	571865	3.82	95.90	155.8	23,408	81.6	62.6	72	1203	3047
Kaushambi	0.1	144.71	897	765.6	525.02	263321	4.05	75.93	158.1	32,708	72.8	48.5	83	715	2323
Chandauli	30.54	178.98	768	846.1	463.77	505577	4.42	89.86	141.8	25,911	81.6	60.2	81	1295	3664
Saravasti	17.8	141.63	679	993.8	410.96	375734	3.67	48.20	167.4	16,932	57.1	34.7	103	506	1655
Balrampur	18.1	142.57	642	1071.7	378.31	433514	3.65	33.55	195.3	22,605	59.7	38.4	93	779	3181
Sant Kabir Nagar	2.5	158.75	1041	990.7	350.16	377729	4.73	53.48	163.5	20,669	78.4	54.7	65	1156	2111

Source: Sankhyiki patrika, Uttar Prdesh 2015-16, Statistical diary 2015, Annual Health Survey (2011-12), Dairying in Uttar Pradesh: A statistical profile 2017

Table 2. Individual indices to capture the ecological, economic and equity indices for agricultural sustainability in Uttar Pradesh

Districts	Ecology security index(ESI)					Economic efficiency index(EEI)					Social Equity Index (SEI)				
	Forest area	Cropping intensity	Population density	Rainfall	Livestock population density	Total food grain yield	Milk yield per animal	Irrigation intensity	Fertilizer consump-tion	Per capita income	Male literacy rate	Female literacy rate	Infant mortality rate	Village electrified	Rural road connectivity
Pratapgarh	0.0027	0.72	0.73	0.19	0.29	0.48	0.14	0.92	0.10	0.29	0.93	0.74	0.27	0.50	0.48
Allahabad	0.0801	0.48	0.62	0.10	0.52	0.68	0.32	0.80	0.10	0.99	0.96	0.82	0.27	0.79	1.00
Behraich	0.2941	0.78	0.81	0.51	0.36	1.00	0.05	0.19	0.29	0.40	0.04	0.14	0.67	0.30	0.23
Gonda	0.0659	0.54	0.72	0.58	0.34	0.73	0.12	0.87	0.74	0.48	0.46	0.39	0.56	0.40	0.33
Faizabad	0.0259	0.55	0.63	0.50	0.67	0.37	0.69	0.92	0.76	0.92	0.79	0.76	0.09	0.23	0.23
Sulatanpur	0.0044	0.61	0.73	0.17	0.58	0.36	0.11	0.83	0.54	1.00	0.91	0.78	1.00	0.41	0.31
Siddarth Nagar	0.0255	0.42	0.71	0.54	0.28	0.85	0.82	0.89	0.22	0.31	0.52	0.40	0.22	0.48	0.17
Maharajganj	0.3614	1.00	0.70	1.00	0.22	0.79	0.92	0.32	0.31	0.35	0.70	0.44	0.29	0.21	0.23
Basti	0.0324	0.11	0.70	0.40	0.13	0.37	0.80	0.94	0.92	0.49	0.78	0.67	0.35	0.61	0.26
Gorakhpur	0.0368	0.51	0.50	0.91	0.45	0.66	1.00	0.61	0.26	0.74	0.93	0.77	0.76	0.68	0.39
Deoria	0.0017	0.66	0.55	0.41	0.31	0.52	0.89	0.92	0.29	0.35	0.98	0.77	0.51	0.37	0.27
Mau	0.0063	0.73	0.52	0.53	0.64	0.25	0.82	1.00	0.37	0.56	0.95	0.91	0.49	0.30	0.15
Azamgarh	0.0000	0.73	0.59	0.42	0.60	0.98	0.80	0.97	0.44	0.19	0.91	0.82	0.44	1.00	0.61
Jaunpur	0.0008	0.75	0.61	0.24	0.48	0.89	0.34	0.80	0.39	0.23	1.00	0.78	0.45	0.66	0.70
Ballia	0.0000	0.58	0.62	0.14	0.22	0.61	0.79	0.77	0.35	0.41	1.00	0.78	0.56	0.41	0.24
Ghazipur	0.0002	0.67	0.62	0.26	0.57	0.71	0.53	0.89	0.19	0.43	0.96	0.80	0.38	0.40	0.57
Varanasi	0.0002	0.68	0.00	0.35	1.00	0.14	0.64	0.81	0.50	0.97	1.00	1.00	0.45	0.14	0.21
Mirzapur	0.5045	0.27	0.86	0.30	0.37	0.39	0.05	0.63	0.00	0.57	0.82	0.69	0.36	0.43	0.43
Sonebhadra	1.0000	0.00	1.00	0.34	0.00	0.78	0.00	0.00	0.19	0.91	0.67	0.54	0.75	0.23	0.94
Bhadohi	0.0017	0.26	0.41	0.18	0.91	0.00	0.14	0.77	0.10	0.52	0.91	0.67	0.42	0.04	0.00
Kushinagar	0.0054	0.41	0.55	0.88	0.35	0.37	0.99	0.88	0.98	0.23	0.77	0.55	0.36	0.34	0.33
Ambedkarnagar	0.0023	0.73	0.65	0.31	0.43	0.52	0.13	0.98	0.35	0.35	0.92	0.87	0.56	0.24	0.21
Kaushambi	0.0017	0.32	0.71	0.00	0.44	0.13	0.28	0.70	0.39	0.85	0.59	0.43	0.36	0.07	0.11
Chandauli	0.6384	0.93	0.77	0.18	0.33	0.44	0.53	0.90	0.13	0.48	0.92	0.80	0.40	0.27	0.30
Saravasti	0.3719	0.27	0.81	0.51	0.23	0.27	0.03	0.31	0.54	0.00	0.00	0.00	0.00	0.00	0.02
Balrampur	0.3782	0.28	0.83	0.68	0.17	0.35	0.01	0.10	1.00	0.31	0.10	0.12	0.18	0.09	0.23
Sant Kabir Nagar	0.0519	0.57	0.64	0.50	0.12	0.28	0.74	0.39	0.48	0.20	0.80	0.63	0.69	0.22	0.08

Table 3. Relative agricultural sustainability status of Uttar Pradesh

Districts	Ecological security status		Economic efficiency status		Social equity status		Sustainable livelihood security status	
	Ecology security index (ESI)	Rank	Economic efficiency index (EEI)	Rank	Social equity index (SEI)	Rank	Sustainable livelihood security index (SLSI)	Rank
Pratapgarh	0.39	21.00	0.36	21.00	0.58	9.00	0.44	19.00
Allahabad	0.36	23.00	0.49	15.00	0.77	1.00	0.54	7.00
Behraich	0.55	3.00	0.35	23.00	0.28	25.00	0.39	23.00
Gonda	0.45	11.00	0.47	16.00	0.43	19.00	0.45	18.00
Faizabad	0.48	6.00	0.73	1.00	0.42	20.00	0.54	5.00
Sulatanpur	0.42	16.00	0.56	10.00	0.68	5.00	0.55	4.00
Siddarth Nagar	0.40	19.00	0.49	12.00	0.36	23.00	0.41	22.00
Maharajganj	0.66	1.00	0.42	20.00	0.38	22.00	0.48	14.00
Basti	0.27	27.00	0.63	6.00	0.53	16.00	0.48	15.00
Gorakhpur	0.48	5.00	0.64	5.00	0.71	4.00	0.61	1.00
Deoria	0.39	20.00	0.56	8.00	0.58	10.00	0.51	12.00
Mau	0.49	4.00	0.65	4.00	0.56	13.00	0.57	3.00
Azamgarh	0.47	9.00	0.58	7.00	0.75	2.00	0.60	2.00
Jaunpur	0.42	17.00	0.43	19.00	0.72	3.00	0.52	10.00
Ballia	0.31	25.00	0.56	9.00	0.60	8.00	0.49	13.00
Ghazipur	0.42	14.00	0.49	13.00	0.62	7.00	0.51	11.00
Varanasi	0.41	18.00	0.65	3.00	0.56	12.00	0.54	6.00
Mirzapur	0.46	10.00	0.31	24.00	0.55	14.00	0.44	20.00
Sonebhadra	0.47	8.00	0.30	25.00	0.63	6.00	0.46	17.00
Bhadohi	0.35	24.00	0.36	22.00	0.41	21.00	0.37	24.00
Kushinagar	0.44	12.00	0.69	2.00	0.47	18.00	0.53	8.00
Ambedkarnagar	0.42	15.00	0.43	18.00	0.56	11.00	0.47	16.00
Kaushambi	0.29	26.00	0.49	14.00	0.31	24.00	0.37	25.00
Chandauli	0.57	2.00	0.49	11.00	0.54	15.00	0.53	9.00
Shravasti	0.44	13.00	0.25	27.00	0.00	27.00	0.23	27.00
Balrampur	0.47	7.00	0.28	26.00	0.14	26.00	0.30	26.00
Sant Kabir Nagar	0.38	22.00	0.43	17.00	0.48	17.00	0.43	21.00

lower than 0.4. Moreover, many districts in coastal Orissa had shown better performance in agricultural sustainability in comparison to the districts of western Orissa as a whole.

Policy Implications

The special concern should be given on Shravasti and Balrampur districts by generating employment, equity-enhancing for better education, health facilities, sanitary living environment, and rural infrastructure for both road connectivity and electrification should be given priority.

In general, in Uttar Pradesh, more emphasis should be given towards economic as well as social development to improve their sustainable livelihood security.

For generating a sustainable livelihood system, optimum use of local resources and better management of the environment should be incorporated. So that,, these experiences could build on people's own knowledge, skill and their

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 71-76
DOI: 10.5958/2322-0430.2018.00038.0

NAAS Score: 4.82
www.naasindia.org
UGC Approved

How Profitable is Agriculture in Indian Punjab: An Insight from Cost of Cultivation Surveys

Vikrant Dhawan[1], J.M. Singh[2] and Kashish[3]

[1]*ATMA, Deputy Project Director o/o Chief Agriculture Office, Roopnagar-140001 (Punjab)*
[2]*Senior Agricultural Economist and* [3]*Ph.D. Scholar, Department of Economics and Sociology Punjab Agricultural University Ludhiana-141004 (Punjab)*

[*]*Corresponding author's email: vikrantdhawann@yahoo.com*

Received: December 03, 2017 *Manuscript Number: NS-18-82* *Revision Accepted: February 18, 2018*

ABSTRACT

The study elucidated that profits over A_1 and C_2 costs during the period 1981-82 to 2010-11 went up tremendously by 10.82 and 12.45 percent for wheat crop, 9.92 and 11.36 percent for paddy crop and 8.75 and 9.67 percent, for cotton crop. Cotton is a crop which has seen worse times during the period of study as serious pest attacks were recorded during the 1990's which affected its production and also led to increase in cost of cultivation. But, with the introduction of Bt cotton varieties, the yield increased and high returns were reaped by farmers growing cotton crop in Punjab. It was inferred from the study that the relative profitability from wheat and cotton crops had increased during the last decade while there was no major change in profitability of paddy crop. So, in order to make farming more remunerative, the Government should emphasize on the development of more high yielding varieties of wheat and rice, training of new farm technology should be given to farmers with emphasis on resource conservation Also, marginal and small farmers should use farm machinery on custom hiring basis to curtail the cost of cultivation.

Keywords
CAGR, cost of cultivation, profitability.

JEL Codes
C82,O13, Q12, Q18.

INTRODUCTION

Agriculture provides livelihood to majority of population and thus remains linchpin of Indian economy. Indian economy is growing and to sustain this growth, agriculture sector has to perform well. The state of Punjab has achieved significant strides in the development of agriculture. It is all due to the spectacular progress made in agriculture by the farmers of Punjab. The Punjab with 1.53 percent of the total geographical area of the country is consistently contributing 60-70 percent of wheat and about 45-50 percent rice to the central pool (Singh, 2012). The production of wheat has increased from 19.66 lakh tonnes in 1965-66 to 179.82 lakh tonnes in 2011-12. In fact, if we compare the production of wheat in 2011-12 with the production wheat in 1965-66, it has gone up by more than nine times. The minimum support price is recommended by Commission for agricultural costs and prices (CACP) and announced by the Government of India. The emergence of agricultural Price Policy in India was in the backdrop of food scarcity and price fluctuations provoked by drought, floods and international prices for exports and imports. However, the minimum support price of the crops seem to have favoured rice and wheat crops and resulted in the shift of good quality land and resources to these crops, away from pulses, oilseeds, and coarse grains (Krishnaji, 1991). Because of decline in the real minimum support prices during the past five years with stagnant or marginal change in yield, the economic condition of farmers of most of the crops has deteriorated (Bhatia, 2006 & Singh *et al.,* 2011). Farmers with large size holding may be considered fortunate to reap the advantage of the present minimum support price policy as they have relatively large marketed surplus but farmers with small size of

holding who cannot afford heavy investment on irrigation structure and have relatively very small marketed surplus fail to get the adequate benefits of minimum support price policy of the Government and the modern agricultural technology that demands bigger investments. The increase in Minimum Support Price (MSP) resulted in increase in cost of cultivation of wheat and paddy by the farmers as new technology was encouraged (Raghavan, 2008). Some recent studies have observed that stagnation in real income and relatively higher rise in input prices, than the prices of the agricultural produce, could be the reasons for farmers' suicides (Kalamkar & Narayanamoorthy, 2003; Narayanamoorthy 2006; 2007; Deshpande & Arora, 2010; Sainath, 2010). The economic condition of a vast majority of farmers was observed to have deteriorated and could not be improved with the existing cropping system and technology which had already been exploited to 75 percent potential (Chand, 1999). The returns over paid-out costs for rice crop also declined at 1.15 percent per annum in real terms leading to distress. A higher emphasis has to be given to non-price interventions through public investments to supplement price policy measures (Dev & Rao, 2010). The National Commission on Farmers (NCF) has also recognized that inadequate return from the crop cultivation is the main reason for the present agrarian crisis and farm suicides (National Commission on Farmers, 2006). How to produce more of agriculture produce with limited natural resources in sustainable manner for ensuring food and nutritional security and increasing income of farmers, are major challenges before the state. In the light of the above-said facts, the present study was undertaken to study the trends in profits from the crops that have been adopted by the farmers in Punjab after the introduction of minimum support price policy of the Government of India.

DATA AND METHODOLOGY

To study the trends in profits over time from the major crops raised in Punjab, data were taken from the 'Comprehensive scheme for studying cost of cultivation of principal crops in Punjab' and reports of the Commission for Agricultural Costs and Prices, Department of Agriculture and Cooperation, Ministry of agriculture and Farmers Welfare, Government of India, New Delhi (CACP, 2012).

Analytical Techniques

Compound growth rates: The compound growth rates were calculated by fitting the exponential function to data related to costs and prices of major crops of the Punjab state.

$Y = ab^t$

Y = Dependent variable

a = Constant term

b = (1+r), regression coefficient

r = (b-1) 100, Compound growth rate in percentage

t = Time variable

The trends in profits over time from major crops grown in Punjabwere worked out by taking into consideration various costs. The cost concepts used in the analysis were as under:

Cost A_1

(i) Value of hired human labour
(ii) Value of hired bullock labour
(iii) Value of owned bullock labour
(iv) Value of owned machine labour
(v) Value of hired machine labour
(vi) Hired machinery charges
(vii) Value of seed (both farm produced and purchased)
(viii) Value of insecticides and pesticides
(ix) Value of manure (owned and purchased)
(x) Value of fertilizers
(xi) Irrigation charges
(xii) Depreciation of implements and farm buildings
(xiii) Land revenue cess and other taxes (if any)
(xiv) Interest on working capital
(xv) Misc. expenses (artisans etc.)

Cost A_2 = Cost A_1 + Rent charges for leased in-land

Cost B_1 = Cost A_1 + Interest on value of owned fixed capital assets (excluding land).

Cost B_2 = Cost B_1 + Rental value of owned land (net of land revenue) + rent paid for leased-in land

Cost C_1 = Cost B_1 + imputed value of family labour

Cost C_2 = Cost B_2 + Imputed value of family labour

Cost C_2* = Cost C_2 + Additional value of human labour based on use of higher wage rate in consideration of statutory minimum wage.

Cost C_3 = Cost C_2* + 10 percent of cost C_2* to account for managerial input of the farmer.

The compound growth rates were calculated for A_1 and C_2 costs for wheat, paddy and cotton crops during 1980-81 to 2010-11. The trends of profitability as returns over A_1 and C_2 costs from these crops in Punjab were examined separately from value of total output (VOTP).

RESULTS AND DISCUSSION

Profitability in Wheat Crop

Green revolution brought significant changes in the world of wheat cultivation as new varieties were introduced with better production and good economic returns to the farmer's. Table 1 presents the details of cost of cultivation, value of total output (VOTP) and profit for wheat crop. Profit of the crop is estimated by deducting the value of crop output from the cost of cultivation under two scenarios, namely C_2 and A_1 costs. It was expected that the farmers must be reaping high profit from wheat cultivation. But, this was not borne out from the analysis of CACP data. It was inferred from the analysis that the farmers were able to make some margin of profit, the cost C_2 was found to be 1454.59 during 1970-71 and profits revealed over C_2 and A_1 costs were ₹527.94 and ₹1166.99 which increased to ₹1438.75 and ₹5439.26 in 1990-91

and further estimated to be ₹15148.53 and ₹41324.23, respectively during 2010-11. For instance, in relation to cost C_2 and A_1 at current prices, the profits were only ₹1438.75 per ha and ₹5439.26 per ha respectively during 1990-91, but then showed a tremendous increase to ₹9266.84 per ha and ₹22105.16 per ha in 2000-01. The percent share of A_1 and C_2 costs in VOTP declined after 1980-81 and was 28.91 and 73.94 percent of VOTP in 2010-11. It can be clearly seen from the table that the VOTP has increased from ₹1982.53 to ₹58132.51 per hectare during the period 1970-71 and 2010-11 but costs of cultivation has also increased during this span of time because of mechanization, new high yielding varieties (HYV's) of wheat, plant protection expenses and with the increasing use of chemical fertilizers.

Compound Annual Growth Rates (CAGR) of Costs and Profit Trends of Wheat crop in Punjab

The compound growth rates of cost and profit trends of wheat crop have been shown in Table 2. The profits of wheat over A_1 and C_2 costs over the study period (1981-82 to 2010-11) went up tremendously by 10.82 and 12.45 percent respectively. The A_1 and C_2 costs were boost up to maximum during the technological breakthrough period (1991-92 to 2000-01) to 8.52 and 9.80 percent respectively but despite of this, value of total product (VOTP) was also recorded highest as 18.48 percent during that period. As a result of this, the maximum profits for wheat crop shows non- significant growth over A_1 and C_2 costs which were 21.04 and 26.72 percent respectively recorded during that period of time. During 1981-82 to 1990-91, the growth in value of total product (VOTP) was 8.25 percent which showed a tremendous increase to 18.48 percent during 1991-92 to 2000-01 and then declined to 9.18 percent during 2001-02 to 2010-11. The table also indicates that growth of profits of wheat crop also declined to 10.77 and 13.04 percent for A_1 and C_2 costs respectively during 2001-01 to 2010-11 and costs incurring for production also declined because of saturation point reached for the inputs, technology and soil health conditions of Punjab.

Profitability in Paddy Crop

Paddy is an important food grain crop cultivated predominantly in Punjab state. After the introduction of green revolution, area share of paddy crop increased in the total food grains area. Table 3 presents the details of cost of cultivation, value of total output (VOTP) and profit for paddy crop. Profit of the crop was estimated by deducting the value of crop output with the cost of cultivation under two scenarios, namely C_2 and A_1 costs. It was expected that the farmers must be reaping high profit from paddy cultivation. But, this was not borne out from the analysis of CACP data. It can be concluded from the analysis that the farmers were able to make some margin of profit, the cost C_2 was found to be higher than value of crop output during 1974-75 and profits revealed over C_2 and A_1 cost were ₹-433.61 and ₹746.94 which increased to ₹6023.20 and ₹1267.82 in 1990-91 and hovered around ₹42261.94 and ₹15913.30, respectively during 2010-11. For instance, in relation to cost C_2 and A_1 at current prices, the profits were only ₹1267.82 per ha and ₹6023.20 per ha during 1990-91, but had increased to ₹15913.3 per ha and ₹42261.94 per ha in 2010-11. It can also be concluded that

Table 1. Cost of cultivation, value of output and profit in wheat (current prices)

(₹/ha)

Year	VOTP	A_1	C_2	Profit over A_1	Profit over C_2	A_1 percent to VOTP	C_2 percent to VOTP
1970-71	1982.53	815.54	1454.59	1166.99	527.94	41.14	73.37
1980-81	3579.38	2095.85	3439.47	1483.53	139.91	58.55	96.09
1990-91	9441.05	4001.79	8002.3	5439.26	1438.75	42.39	84.76
2000-01	31803.77	9698.61	22536.93	22105.16	9266.84	30.50	70.86
2010-11	58132.51	16808.28	42983.98	41324.23	15148.53	28.91	73.94

Source: Computed from CACP (various years).
VOTP: Value of total output.

Table 2. Compound annual growth rates (CAGR) of costs and profit trends of Wheat crop in Punjab

(Percent/annum)

Period	Cost A_1	Cost C_2	VOTP	Profit over A_1	Profits over C_2
1981-82 to 1990-91	6.56^{***}	8.01^{***}	8.25^{***}	9.60^{***}	9.36^{NS}
1991-92 to 2000-01	8.52^{***}	9.80^{***}	18.48^{**}	21.04^{NS}	26.72^{NS}
2001-02 to 2010-11	5.92^{***}	7.81^{***}	9.18^{***}	10.77^{**}	13.04^{***}
1981-82 to 2010-11	7.57^{***}	8.70^{***}	9.65^{***}	10.82^{***}	12.45^{***}

******and ** Significant at 1 and 5 percent level.***
NS: Non-significant.

due to introduction of new hybrid varieties and also with mechanization, the profits from paddy crop increased and cost of cultivation also increased during the study period.

Compound Annual Growth Rates (CAGR) of Cost and Profit Trends of Paddy Crop in Punjab

The changes in the various costs and profits of paddy in the Punjab state over a period from 1981-82 to 2010-11 have been presented in Table 4. The profits from paddy crop over A_1 and C_2 costs during the study period (1981-82 to 2010-11) went up tremendously by 9.92 and 11.36 percent, respectively. Among seasonal crops, paddy remains the most profitable crop in *kharif* and wheat remains the second most profitable crop after peas in *rabi* (Raju *et al*., 2015). The A_1 and C_2 costs were boost up to maximum during period 1991-92 to 2000-01 and these were 7.86 and 8.27 percent, respectively. The maximum profits for paddy crop over A_1 and C_2costs, which were 11.62 and 14.63 percent, respectively were recorded during 2001-02 to 2010-11 periods. During 1981-82 to 1990-91, the growth in value of total product (VOTP) was 6.19 percent which showed an increase of 8.84 percent during 1991-92 to 2000-01 period and hovered around 9.35 percent during 2001-02 to 2010-11. The table also indicates that growth of costs and profits showed a significant rise during the study period as a result of green revolution which brought new cultivation techniques, HYV's, minimum support prices, etc. to the farmers to fetch maximum prices for their produce.

Profitability in Cotton Crop

New scientific techniques brought significant changes in the world of cotton cultivation as new transgenic varieties (Bt cotton) were introduced with better production, resistance to some insects and pests and good economic return to the farmers. Table 5 presents the details of cost of cultivation, value of total output (VOTP) and profit for cotton crop. Profit of the crop was estimated by deducting the value of crop output from the cost of cultivation under two scenarios, namely C_2 and A_1 costs. Cotton is a crop which has seen worse times during the period of study as serious pest attacks were recorded during 90's which affected its production and also led to increase in cost of cultivation but with the change in time, new varieties were introduced and gave a whole new shape to scenario of cotton cultivation by providing good economic returns to the farmers. It was concluded from the analysis that the farmers were able to make some margin of profit, the cost C_2 was found to be 1535.96 during 1972-73 and profits calculated over C_2 and A_1 cost were ₹397.78 and ₹1281.31 which increased to ₹778.73 and ₹5150.54 in 1990-91 and hovered around ₹26224.71 and ₹59141.96 during 2010-11 respectively. With cost C2 rising abnormally, the cotton farmers of Maharashtra have been struggling to get a steady profit which generally fluctuates every alternate year (Narayanamoorthy *et al.,* 2014). However, HYVs come at a price, escalating the cost of cultivation. These empirical findings need to be re-assessed to bring out the real picture at the ground level (Narayanamoorthy & Suresh, 2012). The cost C_2 and A_1at

Table 3. Cost of cultivation, value of output and profit in paddy (current prices)

(₹/ha)

Year	VOTP	Cost A_1	Cost C_2	Profit over Cost A_1	Profit over Cost C_2	Cost A_1 percent to VOTP	Cost C_2 percent to VOTP
1974-75	2460.72	1713.78	2894.33	746.94	-433.61	69.65	117.62
1981-82	6605.49	3311.11	5473.89	3294.38	1131.60	50.13	82.87
1990-91	11350.24	5327.04	10082.42	6023.20	1267.82	46.93	88.83
2000-01	33816.51	10733.67	23577.39	23082.84	10239.12	31.74	69.72
2010-11	67192.64	20930.7	51279.34	42261.94	15913.3	31.15	76.32

Source: Computed from CACP (various years).
VOTP: Value of total output.

Table 4. Compound annual growth rates (CAGR) of cost and profit trends of paddy crop in Punjab

(Percent/annum)

Period	A_1 Cost	C_2 Cost	VOTP	Profit over A_1	Profits over C_2
1981-82 to 1990-91	4.83**	6.04**	6.19**	7.33**	7.12NS
1991-92 to 2000-01	7.86**	8.27**	8.84**	9.36**	9.98***
2001-02 to 2010-11	5.25**	7.74**	9.35**	11.62**	14.63**
1981-82 to 2010-11	6.62**	7.86**	8.58**	9.92**	11.36**

****** and ** Significant at 1 and 5 percent level.***
NS: Non-significant.

current prices were only ₹8758.21 per ha and ₹4386.40 per ha respectively during 1990-91, but then showed a tremendous increase to ₹22298.37 per ha and ₹12146.71 per ha in 2000-01. It was also clearly indicated from the Table 5 that the VOTP has been increased from ₹1933.74 to ₹85506.77 during the period 1972-73 and 2010-11, respectively in Punjab.

Compound Annual Growth Rates (CAGR) of Cost and Profit Trends of Cotton Crop in Punjab

The changes in the various costs and profits of cotton in the Punjab state over a period from 1981-82 to 2010-11 have been presented in Table 6. The profits of cotton over A_1 and C_2 costs over the study period (1981-82 to 2010-11) went up tremendously by 8.75 and 9.67 percent, respectively. The A_1 and C_2 costs were recorded with maximum growth rate during period from 1981-82 to 1990-91 with 11.65 and 12.31 percent, respectively. During 1981-82 to 1990-91, the growth in value of total product (VOTP) was 13.91 percent which showed a negative growth of 2.04 percent during 1991-92 to 2000-01 and then increased tremendously to 16.46 percent during 2001-02 to 2010-11.The time period of 1991-92 to 2000-01 indicates a black decade for the cotton cultivating farmers as the value of total product shows a decline at 2.04 percent and growth of profits over A_1 and C_2 costs during that period shows negative growth rate at 11.50 and 8.31 percent, respectively. The attack of pests and weather conditions during that period was the major cause for the losses. The maximum profits for cotton crop over A_1 and C_2 costs were at 32.47 and 20.74 percent, respectively during 2001-02 to 2010-11 period due to introduction of new Bt cotton varieties with good economic returns and having resistance to many insects and pests.

CONCLUSIONS AND SUGGESTIONS

The profits from paddy crop over A_1 and C_2 costs during the period 1981-82 to 2010-11 went up by 9.92 and 11.36 percent, respectively. The A_1 and C_2 costs increased maximum during the period 1991-92 to 2000-01 and these were 7.86 and 8.27 percent, respectively. The profits from wheat crop over A_1 and C_2 costs during the period 1981-82 to 2010-11 went up tremendously by 10.82 and 12.45 percent, respectively. The A_1 and C_2 costs for wheat crop have increased by 8.52 and 9.80 percent during the technological breakthrough period (1991-92 to 2000-01). The profits from cotton crop over A_1 and C_2 costs during the period 1981-82 to 2010-11 went up by 8.75 and 9.67 percent, respectively. The A_1 and C_2 costs were recorded with maximum growth rate during period from 1981-82 to 1990-91 with 11.65 and 12.31 percent, respectively. Cotton is a crop which has seen worse times during the period of study as serious pest attacks were recorded during the 1990's which affected its production and also led to increase in cost of cultivation. Farmers especially marginal and small ones should be advised for making judicious use of farm machinery by taking it on custom hiring basis for making their farming viable. It is found that the farmers have suffered losses both due to increased cost of cultivation in some crops and due to reduction in value of output in some other crops. Continued suffering of losses and a low margin of profit from crop cultivation would

Table 5. Cost of cultivation, value of output and profit in cotton (current prices)

(₹/ha)

Year	VOTP	A_1	C_2	Profit over A_1	Profit over C_2	A_1 percent to VOTP	C_2 percent to VOTP
1972-73	1933.74	652.43	1535.96	1281.31	397.78	33.73	79.42
1980-81	3472.68	1570.75	3095.85	1901.93	376.83	45.23	89.14
1990-91	9536.94	4386.40	8758.21	5150.54	778.73	45.99	91.83
2000-01	23260.79	12146.71	22298.37	11114.08	962.42	52.22	95.86
2010-11	85506.77	26364.81	59282.06	59141.96	26224.71	30.83	69.33

Source: Computed from CACP (various years).
VOTP: Value of total output.

Table 6. Compound annual growth rates (CAGR) of cost and profit trends of cotton crop in Punjab

(Percent/annum)

Period	A_1 Cost	C_2 Cost	VOTP	Profit over A_1	Profits over C_2
1981-82 to 1990-91	11.65^{**}	12.31^{**}	13.91^{**}	15.53^{***}	14.49^{NS}
1991-92 to 2000-01	7.95^{**}	6.36^{**}	-2.04^{NS}	-11.50^{NS}	-8.31^{NS}
2001-02 to 2010-11	5.02^{**}	8.56^{**}	16.46^{**}	32.47^{**}	20.74^{**}
1981-82 to 2010-11	10.63^{**}	10.25^{**}	9.71^{**}	8.75^{**}	9.67^{**}

**** and ** Significant at 1 and 5 percent level.*
NS: Non-significant.

definitely discourage farmers from engaging in agriculture (Swaminathan, 2008). As Profitability of any crop is always related with its productivity, which is highlighted by many studies (Bhalla & Singh, 2012). So, the Government need to take following initiatives i.e. development of more yielding varieties of wheat and rice, training of new farm technology should be given to farmers, resource conservation techniques such as direct seeded rice (DSR), tensiometer, leaf colour chart (LCC), happy seeder and zero tillage can be more helpful in making Punjab agriculture sustainable. As the performance of different crop establishment options such as of zero tillage raised bed planting, and surface seeding are known to improve significantly on laser levelled fields (Jat *et al.*, 2006). The National Commission on Farmers under the chairmanship of Professor M.S. Swaminathan in their report summary (National Commission on Farmers, 2006a) suggested that the minimum support price (MSP) should be at least 50 percent more than the weighted average cost of production. Another reason for the low income of farmer households could be the dominant role played by the middlemen in the market. The role of middlemen can be controlled to a large extent by directly involving producers in the market activities extensively. So, direct payment to farmers for their produce should be made. Studies show that farmers are not able to get even 40 percent of the consumer rupee for various agricultural commodities in the market Finally, it is appropriate to end the paper with a quote from the National Commission on Farmers: Economic growth which bypasses a large population is joyless growth and not sustainable in the long run. We cannot be silent onlookers to a situation where 30 percent of India is shining and 70 percent is weeping, 40 percent of the farmers wish to quit farming (Narayanamoorthy, 2001).

REFERENCES

Bhalla, G.S., & Singh, G. (2012). *Economic liberalization and Indian agriculture: A district-level study.* New Delhi, India: Sage Publications India Private Limited.

Bhatia, M.S. (2006). Sustainability and trends in profitability of Indian agriculture. *Agricultural Economics Research Review, 19, 89-100.*

CACP. (2012). *Report of the Commission for Agricultural Costs and Prices.* Commission for Agricultural Costs and Prices (CACP), Ministry of Agriculture, Government of India, New Delhi, India.

Chand, R. (1999). Emerging crisis in Punjab agriculture. *Economic and Political Weekly, 34*, A1-A10.

Deshpande, R.S., & Arora, S. (2010). *Agrarian crisis and farmer suicide*. New Delhi, India: Sage Publications.

Dev, S.M., & Rao, N.C. (2010). Agricultural price policy, farm profitability and food security. *Economic and Political Weekly, 45*, 174-182.

Jat, M.L., Chandna, P. Gupta, R.K. S., Sharma, K., & Gill, M.A. (2006). *Laser land levelling: A precursor technology for resource conservation. Rice-wheat consortium technical bulletin series 7.* New Delhi: Rice-Wheat Consortium for the Indo-Gangetic Plains, p. 48.

Kalamkar, S.S., & Narayanamoorthy, A. (2003). Impact of liberalization on domestic agricultural prices and farm income. *Indian Journal of Agricultural Economics, 58*, 353-364.

Krishnaji, N. (1991). Agricultural price policy in Asia. *Indian Journal of Agricultural Economics, 146,* 186-192.

Narayanamoorthy, A. (2001). Profitability in crops cultivation in India: some evidence from cost of cultivation survey data. *Indian Journal of Agricultural Economics, 68*, 104-121.

Narayanamoorthy, A. (2006). Relief package for farmers: Can it stop suicides? *Economic and Political Weekly, 41*, 3353-3355.

Narayanamoorthy, A. (2007). Deceleration in agricultural growth: Technology fatigue or policy fatigue. *Economic and Political Weekly, 42*, 2375-2379.

Narayanamoorthya, A, Allib, P., & Suresh, R. (2014). How profitable is cultivation of rainfed crops? Some insights from cost of cultivation studies. *Agricultural Economics Research Review, 27*, 233-241.

Narayanamoorthy, A., & Suresh, R. (2012). Agricultural price policy in India: Has it benefitted the paddy farmers*? Indian Journal of Agricultural Marketing, 26*, 87-106.

National Commission on Farmers. (2006). *Serving farmers and saving farming (Report V Excerpts).* The National Commission on Farmers, Ministry of Agriculture, Government of India, New Delhi, India. Retrieved from www.krishakayog.gov.in.

National Commission on Farmers. (2006a). *Swaminathan Committee on Farmers-Report summary*. In National Commission on Farmers under Chairmanship of M.S. Swaminathan, prepared by Kaushiki Sanyal.

Raghavan, M. (2008).Changing pattern of input use and cost of cultivation. *Economic and Political Weekly, 43,* 123-129.

Raju, S.S., Chanda, R., Srivastava, S.K., Kaura, A.P., Singha, J., Jaina, R., mmanuelraja, K., & Kaur, P. (2015). Comparing performance of various crops in Punjab based on market and economic prices and natural resource accounting. *Agricultural Economics Research Review, 28*, 189-198.

Sainath, P. (2010, January 25). Farm suicides-A 12-year saga.*The Hindu*.

Singh, G. (2012). Lack of diversification and declining growth profitability and surpluses of Punjab agriculture. *International Index Refereed and Research Journal, 3*, 42-44.

Singh, S., Park, J., & Litten-Brown, J. (2011). The economic sustainability of cropping systems in Indian Punjab: A farmer perspective. Presented at the *International Congress of European Association of Agricultural Economists*, Switzerland.

Swaminathan, M.S. (2008, March 3). Ending the debt trap and attaining food security. *The Hindu.*

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 77-82
DOI: 10.5958/2322-0430.2018.00039.2

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Adoption of Resource Conservation Technologies for Sustainable Production: Evidence of Potential Impact from Haryana

Anuj Kumar[1], Randhir Singh[2], Satyavir Singh[1], Sendhil, R.[1], Ramesh Chand[3] and J.K. Pandey[1]*

[1]*ICAR-Indian Institute of Wheat and Barley Research, Karnal-132001 (Haryana)*
[2]*ADG (Extension), Indian Council of Agricultural Research, KAB I, Pusa, New Delhi-110012*
[3]*Joint Director, Farm Information, Directorate of Extension, VistarBhawan, New Delhi-110012*

[*]*Corresponding author's email: anuj.kumar1@icar.gov.in*

Received: January 12, 2018 *Manuscript Number: NS-18-84* *Revision Accepted: March 04 2018*

ABSTRACT

Resource conservation technologies (RCTs) are a win-win situation for farmers as well as environment owing to their potential benefits. The study was conducted during 2013-14 Rabi crop season with 120 purposively selected RCT farmers from sixvillages of Kurukshetra district in Haryana. Findings indicated that a majority of the farmers (95.24 percent) reported saving of time under zero tillage sowing. A majority of them (51.20 percent) used same quantity of seed rate, about 48.8percent of the farmers found more germination under zero tillage, 46.43percent observed increase in broadleaf weeds under zero tillage. About 26 percent of farmers harvested similar yield while 61.9percent recorded more yield as compared to conventional tillage. Adopters further recorded increase in soil fertility (79.76 percent), organic carbon (83.33 percent) and increased moisture retention capacity of soil (84.53 percent), less lodging (85.71 percent) and avoidance of terminal heat (61.90 percent). Almost all the farmers used similar quantity of wheat seed under rotary tillage as compared to conventional tillage. Around 45percent of the respondents observed better germination under rotary tillage. Most of the farmers (77.63 percent) witnessed a decline in the cost of cultivation and 78.94 percent got more yield under rotary tillage. The time for leveling of one acre of land ranged from 1 hour to 3.5 hours in the study area. Due to the adoption of laser land leveler, there was around 2-3 percent increase in area under cultivation, saving of one-third time to irrigate crop and 30-40percent water saving. All the farmers (100 percent) recorded more yield and less lodging (84.38 percent) in laser-leveled fields. The study recommends for mass adoption of RCTs to reap the potential benefits paving way for sustainable production.

Keywords
Adoption, extension contact, impact, RCTs, resource conservation technologies, sustainable production.

JEL Codes
Q01, Q16, Q55.

INTRODUCTION

Wheat is the second most important crop in terms of area and production in India. The total area under wheat was 30.59 million hectares and the production was 98.38 million tonnes during 2016-17. In recent years, resource conservation technologies (RCTs) have made significant impact on wheat production under rice-wheat system, especially in the Indo-Gangetic Plains. Literature report that there has been significant increase in area under zero tillage (ZT), rotavator and laser land leveler in Haryana. The ZT adoption had witnessed a substantial increase in the districts where rice-wheat was the main sequential rotation (Conventry *et al*., 2015). The adoption of RCTs have ensured better yield and saving of several inputs, such aslabour, time, money, diesel and the most crucial input, water (Singh *et al.,* 2007, 2009). It has also provided solution to burning of straw in major wheat-growing states (Kumar *et al*., 2017, 2017a).In initial years, the adoption of zero tillage was slow, then it got momentum and finally stabilized in a few districts.As of now, it is area specific which is evident from reports that Kaithal and Kurukshetra districts of Haryana have the highest level of adoption of ZT (Coventry *et al.,*2015). The rotary tillage technology has got a good momentum and is being popularized under food security mission across the country. In recent years, realization about

leveling of fields with laser land leveler has been given high priority for efficient water usage. In the context, the present study has been attempted to assess the impact of all these resource conservation technologies at farmers' field to supplement the research findings.

DATA AND METHODOLOGY

The study was conducted in Kurukshetra district of Haryana during 2013-14 Rabi crop season. Six villages namely Bapdi, Mathana, Teukar, Thuska, Jhansa, and Yara were selected purposively from all the four blocks *viz.,* Ladwa, Peohwa, Thaneshar, and Shahbad. A total of 120 farmers were selected purposively from this cluster of villages and primary data were collected from the farmers who have adopted either of the three resource conservation technologies *viz*.; zero tillage, rotary tillage, and laser land leveler or in combination. Conventional tools like tabular analysis, frequency, and percentages, as well as graphical analysis, were employed for arriving meaningful conclusions.

RESULTS AND DISCUSSION

Socio Personal Profile

Age and literacy are important variables that determine the adoption of technologies. A majority of the farmers (58.33 percent) who have adopted RCTs were from middle age group (Singh *et al*., 2008, Kumar *et al*., 2006, Kumar *et al*., 2017, 2017a) followed by young (18.33 percent) and old (23.34 percent) farmers (Table 1). Involvement of young farmers was less in the study area. A majority of the farmers were literate (92.5 percent) corroborating the fact that literacy influences adoption (Kumar *et al*., 2017, 2017a). Out of the total respondents, 28.33 percent were matric, 13.33 percent were middle, 20percent were intermediate, 13.33 percent were graduate and 0.83percent were postgraduate and above. Agriculture was the main occupation of 97.70 percent of the farmers and dairying was subsidiary occupation for 63.33 percent of the farmers (Singh *et al.,* 2008, Kumar *et al*., 2017, 2017a).

Table 1. Socio-personal profile of the farmers

(n=120)

Categories	Frequency	Percentage
Age (Years)		
Young (<33)	22	18.33
Middle (33-55)	70	58.33
Old (>55)	28	23.34
Status of education		
Illiterate	18	07.50
Can read and write	02	01.67
Primary	09	07.5
Middle	16	13.33
Matric	34	28.33
Intermediate	24	20.00
Graduate	16	13.33
Postgraduate and above	01	00.83
Occupation		
Main		
Agriculture	117	97.50
Subsidiary		
1. Dairying	76	63.33
2. Business	03	02.50
3. Agriculture	03	02.50

Landholding

Farmers were categorized on the basis of owned as well as total land holdings (owned+leased-in) and furnished in Table 2. It was found that on owned land holding basis, 11.67, 12.20, 26.67, 35.83, and 13.3percentfarmers were categorized under marginal, small, semi-medium, medium and large holders, respectively. But on total (owned+leased-in) basis under the respective categories, 7.5, 7.5, 23.33, 37.5, and 24.17percentof the farmers were lying. It clearly indicates that taking land on rent/lease is very common practice in Haryana (Kumar *et al*., 2017; 2017a).

The adoption pattern of resource conservation technologies was studied and it was found that 70percent of the farmers had adopted zero tillage, 63.33percent rotary tillage, 53.33 laser land leveler, 38.33percent zero tillage+rotary tillage, 36.37 zero tillage+laser land leveler, 30.83 rotary tillage+laser land leveler and 18.33 zero tillage+ rotary tillage+ laser land leveler (Figure 1). Almost similar adoption pattern has been reported by Kumar *et al*. (2017a) in their study in Haryana.

Although, the adoption of RCTs was high in the study area but possession of RCT machines such as zero till drill, rotavator and laser land leveler was low. High cost was the foremost reason of low possession of RCT machines among the farmers. Hence most of the farmers opted for custom hiring to get their job done and this

Table 2. Distribution of farmers based on land holding

(n=120)

Category of farmers	Owned		Total (owned + leased-in)	
	Frequency	Percentage	Frequency	Percentage
Marginal (<2.5 acre)	14	11.67	9	7.5
Small (2.6-5.0 acre)	15	12.50	9	7.5
Semi-Medium (5.1-10 acre)	32	26.67	28	23.33
Medium (10.1-25 acre)	43	35.83	45	37.5
Large (>25 acre)	16	13.33	29	24.17

practice is very common in Haryana (Kumar *et al*., 2017, 2017a). The average rate of custom hiring for zero tillage was ₹689 per acre and it ranged from ₹700-₹1000, for rotary tillage it was ₹992 per acre and the range were₹800-₹1200. In the case of laser land leveler, average rate was ₹625 per hour and it ranged from ₹500-₹750 per hour in the study area (Kumar *et al*., 2017a).

Adoption of RCTs among different categories of farmers

It is evident from Table 5 and 6 that in the case of adoption of zero tillage (86.21 percent) and rotary tillage (79.30percent), large farmers (above 25 acres land holding) dominates, while for laser land leveler, semi-medium category of farmers (64.29 percent) were leading. The adoption of RCTs in combination of two or three RCTs, large category of farmers had maximum adoption; ZT+RT (65.52 percent), ZT+LLL (48.28 percent), RT+LLL (41.38 percent) and ZT+RT+LLL (34.48 percent). In the case of small and marginal farmers, the maximum adoption was observed for zero tillage and rotary tillage. The semi-medium category of farmers had maximum adoption of ZT (67.86 percent), LLL (64.29 percent) and ZT+LLL (46.43 percent). The medium category of farmers had maximum adoption of ZT (64.44 percent), RT (66.67 percent), ZT+RT (40 percent). It could be concluded from the above findings that all categories of farmers adopted RCTs based on their requirement, availability of machines, and custom hire rate.

Impact of zero tillage technology on wheat cultivation

It was found that a majority of the farmers (95.24 percent) told that there was saving of time under zero tillage sowing (Kumar *et al.,* 2006, Singh *at al*., 2006, 2006a, Kumar *et al*., 2017; Kumar *et al.,* 2017a), while a few (4.76 percent) told it takes same time as compared to conventional tillage. A majority of the farmers (51.20 percent) used same quantity of seed rate as compared to conventional method but 36.96percent of the farmers used 5 kg more seed rate. About 49percent of the farmers found more germination under zero tillage, while 51.2 percent did not find any difference. A large majority of farmers (95.04percent) used same quantity of fertilizer as recommended in conventional tillage. Less than half of the farmers (46.43 percent) observed increase in broadleaf weeds under zero tillage (Kumar *et al*., 2006; Singh *et al*., 2005; Chhokar *et al.,* 2005; Sharma *et al.,* 2005; Chhokar *et al*., 2007, 2008, Kumar *et al*., 2017; 2017a) and 42.46 percent of them observed reduction in narrow leaf weed population (Chhokar *et al.,* 2005, Franke *et al*., 2007, Kumar *et al*., 2017; 2017a). In totality, 34.32 percent of the farmers observed reduction in overall weed population (Singh *et al*., 2016) but 40.48percent of the farmers observed increase and 25percent found no change in weed population as compared to conventional wheat.

Majority of farmers (92.56 percent)recorded cost saving to a tune of ₹1500-2000 per acre due to adoption of zero tillage technology (Singh & Kumar, 2005; Sharma *et al*., 2005; Chauhan *et al.,* 2002, Chauhan *et al.,* 2003, Chhokar *et al*., 2008 and Kumar *et al*., 2017; 2017a). A majority (61.9percent) of the farmers got higher yield (1.5 to 2.0 q per acre)(Coventry *et al*., 2011; Kumar *et al*., 2006, Singh *et al*., 2009, Singh *et al*., 2008, Kumar *et al.,* 2017; 2017a) as compared to conventional tillage while 26.20percent of them harvested similar yield and about 12percent got lesser yield under zero tillage. Most of the farmers (83.33 percent) observed no change in crop duration. Adopters further observed increase in soil fertility (79.76 percent), organic carbon in the soil (83.33 percent) (Chhokar *et al*., 2005; Kumar *et al*., 2017; 2017a)

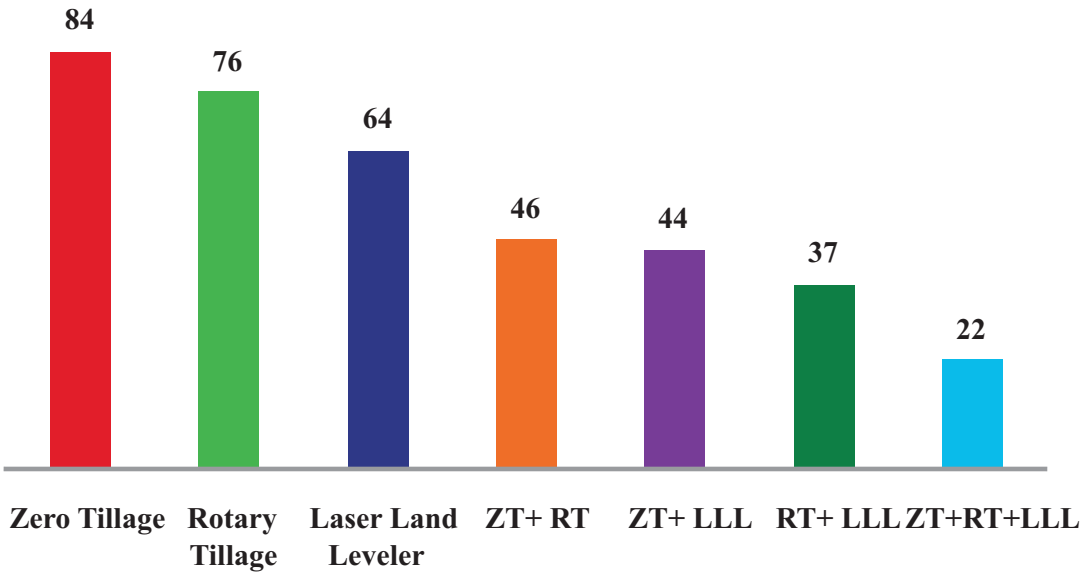


Figure. 1. Adoption of RCTs among the farmers

and increase in moisture retention capacity of soil (84.53 percent) and less lodging (85.71 percent) (Kumar *et al*., 2017; 2017a). Regarding avoidance of terminal heat, about 62 percent of percent farmers responded that it helps to avoid heat stressas under zero tillage loose rice residue is kept on the soil surface which helps to conserve moisture for longer period and also keeps root zone cool.

Impact of rotary tillage on wheat cultivation

All the farmers agreed that there was time-saving under rotary tillage in wheat sowing. It ranged from 40 minutes to 90 minutes for one acre of area. But a majority (84.21 percent) told that it takes one hour for one-acre area. This is one of the reasons of popularity of rotary tillage technology. It was also recorded that most of the small farmers in the study area opted this technology for wheat sowing. About 91 percent of farmers used similar quantity of wheat seed under rotary tillage as compared to conventional tillage. A majority (55.26 percent) observed similar germination whereas 44.74 percent recorded better germination under rotary tillage. All the farmers applied same quantity of fertilizer and also observed similar type of weed flora, similar water requirement in rotary tillage as compared to conventional practice. Most of the farmers (77.63 percent) witnessed a decline in cost of cultivation (Kumar *et al.,* 2017; 2017a) and 78.94percent got more yield under rotary tillage, while 21.06 percent recorded similar yield as compared to conventional tillage.

There was no effect of rotary tillage on crop duration as reported all the farmers. Majority of farmers' 65.79 percent perceived that there isan increase in fertility of soil and organic carbon content of soil (68.42 percent) (Kumar *et al.,* 2017; 2017a). About moisture retention capacity of soil 51.32 percent responded that it is increased. About 48.68 percent of the farmers agreed that there was no change in lodging of crop under rotary tillage but 27.62 percent of them observed more lodging as compared to conventional tillage (Kumar *et al.,* 2017; 2017a). Only 31.58percent of the farmers agreed that this technology helps in avoidance of terminal heat in wheat.

Impact of laser land leveler on wheat cultivation

The average area leveled per farmer was 10.9 acres and the remaining (2.85 acres) was not leveled indicating the growing popularity of this technology. All the farmers were very keen to talk about this technology and were willing to adapt continuously whenever required.

A majority of the farmers (37.50) felt that there was decrease in time required for field preparation when they adopt laser land leveler. The average time for leveling of one acre of land was 1.86 hours but it ranged from 1 hour

Table 5. Adoption of RCTs among different categories of farmers

(N=120, percent)

Category of farmers	No. of farmers	Zero tillage	Rotary tillage	Laser land leveler
Marginal (<2.5 acres)	7.5	66.67	66.67	44.44
Small (2.5-5.0 acres)	7.5	55.55	44.44	44.44
Semi-Medium (5.1-10.0 acres)	23.33	67.86	46.43	64.29
Medium (10.1-25.0 acres)	37.5	64.44	66.67	48.89
Large (>25 acres)	24.17	86.21	79.30	55.17
		70.00	63.33	53.33

Figures within parenthesis indicate the percent.

Table 6. Adoption of RCTs among different categories of farmers

(N=120, percent)

Category of farmers	No. of farmers	ZT+RT	ZT+LLL	RT+LLL	ZT+RT+LLL
Marginal	09	03	03	02	01
(<2.5 acres)	(7.5)	(33.33)	(33.33)	(22.22)	(11.11)
Small	09	01	02	01	01
(2.5-5.0 acres)	(7.5)	(11.11)	(22.22)	(11.11)	(11.11
Semi-Medium	28	05	13	08	04
(5.1-10.0 acres)	(23.33)	(17.86)	(46.43)	(28.57)	(14.29)
Medium	45	18	12	14	06
(10.1-25.0 acres)	(37.5)	(40.00)	(26.67)	(31.11)	(13.33)
Large	29	19	14	12	10
(>25 acres)	(24.17)	(65.52)	(48.28)	(41.38)	(34.48)
	120	46	44	37	22
		(38.33)	(36.67)	(30.83)	(18.33)

Figures within parentheses indicate the percent.

to 3.5 hours depending on the condition of the field. All the farmers observed that there was an increase (2-3 percent) in area under cultivation when they adopted laser land leveler. All the farmers observed that there was reduction to thetune of one-third to half in time taken to irrigate the crop after laser land leveling. All the farmers recorded water saving to the tune of 30-40 percent after adoption of laser land leveler in wheat and rice crops (Kumar *et al*., 2017; 2017a). Fifty percent of the farmers that there is similar cost of cultivation even with the adoption of laser land leveler but 23.44 percent felt that during first year of adoption it increases the cost of cultivation. All the farmers recorded more yield after leveling their field and 84.38percentobserved reduction in lodging of crop due to even distribution of water (*Kumar et al.,* 2017; 2017).

CONCLUSIONS

The adoption of resource conservation technologies in Haryana has been increasing with the realization of

Table 7. Impact of zero tillage technology on wheat cultivation

(n=84, percent)

Indicators	Increase	Same	Decrease
Time taken in sowing	00 (00.00)	04 (4.76)	80 (95.24)
Seed rate	31 (36.96)	43 (51.20)	10 (11.90)
Germination	41 (48.88)	43 (51.20)	00 (00.00)
Fertilizer requirement	05 (05.96)	79 (95.04)	00 (00.00)
Narrow leaf weeds	08 (09.52)	40 (47.62)	36 (42.86)
Broad leaf weeds	39 (46.43)	11 (13.10)	34 (40.47)
Both (Narrow+Broad leaf)	34 (40.48)	21 (25.00)	29 (34.32)
Water requirement	29	21	34
Cost of cultivation	00	06	78
Yield	52 (61.90)	22 (26.20)	10 (11.90)
Crop duration	14 (16.67)	70 (83.33)	00 (00.00)
Fertility of soil	67 (79.76)	17 (20.24)	00 (00.00)
Organic carbon content of soil	70 (83.33)	14 (16.67)	00 (00.00)
Moisture retention capacity of soil	71 (84.53)	13 (15.47)	00 (00.00)
Lodging	00 (00.00)	12 (14.29)	72 (85.71)
Avoidance of terminal heat	52 (61.90)	32 (38.10)	00 (00.00)

Figures within parentheses indicate the percent.

Table 8. Impact of rotary tillage technology on wheat cultivation

(n=76, percent)

Indicators	Increase	Same	Decrease
Time taken in sowing	00 (00)	12 (15.79)	64 (84.21)
Seed Rate	07 (09.21)	69 (90.79)	00 (00.00)
Germination	34 (44.74)	42 (55.26)	00 (00.00)
Fertilizer requirement	00 (00.00)	76 (100.0)	00 (00.00)
Broad leaf weed population	11 (14.47)	59 (77.63)	06 (07.90)
Narrow leaf weed population	06 (07.89)	57 (75.00)	13 (17.11)
Both (Narrow+Broad leaf)	06 (07.90)	51 (67.10)	19 (25.00)
Water requirement	13 (17.10)	49 (64.47)	14 (18.43)
Cost of cultivation	00 (00.00)	17 (22.37)	59 (77.63)
Yield	60 (78.94)	16 (21.06)	00 (00.00)
Crop duration	00 (00.00)	76 (100)	00 (00.00)
Fertility of soil	50 (65.79)	26 (34.21)	00 (00.00)
Organic carbon content of soil	52 (68.42)	24 (31.58)	00 (00.00)
Moisture retention capacity of soil	39 (51.32)	37 (48.68)	00 (00.00)
Lodging	21 (27.62)	37 (48.68)	18 (23.68)
Avoidance of terminal heat	24 (31.58)	52 (68.42)	00 (00.00)

Figures within parenthesis indicate the percent.

Table 9. Impact of laser land leveling on wheat cultivation

(n=64, percent)

Indicators	Increase	Same	Decrease
Time taken infield preparation	20 (31.25)	20 (31.25)	24 (37.50)
Area brought under cultivation	48 (75.00)	16 (25.00)	00 (00.00)
Time taken to irrigate the crop	00 (00.00)	00 (00.00)	64 (100)
Water requirement	00 (00.00)	00 (00.00)	64 (100)
Cost of cultivation	15 (23.44)	52 (50.00)	17 (26.50)
Yield	64 (100)	00 (00)	00 (00.00)
Lodging	00 (00.00)	10 (15.62)	54 (84.38)

Figures within parenthesis indicate the percent.

sustainable production and irrational use of critical inputs such as water, nutrients, energy and time. The findings of the study indicates that awareness among the farmers about soil health, environmental issues and law enforcement by the Government to stop crop residue burning has been increasing which has paved the way for adoption of RCTs. In recent years heavy rain at the time of harvest has also facilitated for the adoption of these technologies as they are capable of withstanding such calamities. The continuous support from the Government of Haryana on all these RCT machines is remarkable to increase the number of farmers under the canopy of RCTs. In the years to come new generation machinery will also be adopted by the farmers. To stop crop residue burning, adoption of RCTs on a larger scale is a possible solution. Extension agencies are suggested to make participatory efforts to popularize all RCTs owing to the multiple benefits for farmers as well as society on a larger perspective for ensuring sustainable production.

REFERENCES

Chauhan, B.S., Yadav, A., & Malik, R.K. (2002). Zero tillage and its impact on soil properties: A brief review. In Malik RK, Balyan, RS, Yadav, A and Pahwa SK (Eds). *Herbicide resistance Management and Zero tillage in Rice-Wheat Cropping System*. CCSHAU, Hisar, India, 109-114.

Chauhan, D.S., Sharma, R.K., & Chhokar, R.S. (2003). Comparative performance of tillage options in wheat (*Triticum aestivum*) productivity and weed management. *Indian Journal of Agricultural. Science.*,*73*,402-406.

Chhokar, R.S., & Sharma, R.K. (2008). Multiple herbicide resistant *Phalaris minor* and its response at alternate herbicides. *Weed Technology*, *16*, 116-123.

Chhokar, R.S., Sharma, R.K., Gathala, M.K., Pundir A.K., & Kumar, Vivek. (2005). Grow zero tillage wheat for more profit. *Intensive Agriculture,* 8-11.

Chhokar, R.S., Sharma, R.K., Jat, G.R., Pundir, A.K., & Gathala, M.K. (2007). Effect of tillage and herbicides on weeds and productivity of wheat under rice-wheat system. *Crop Proectiont,26*, 1689-1696.

Coventry, D.R., Poswal, R.S., Yadav, A., Gupta, R.K., Gill, S.C., & Chhokar, R.S. (2011). Effect of tillage and nutrient management of wheat productivity and quality in Haryana, India, *Field Crops Research, 123*, 234-240.

Conventry, D.R., Poswal, R.S., Yadav, A. Riar, A.S., ... Cummins, J.A. (2015). A comparison of farming practices and performance. *Agricultural Systems, 137*, 139-153.

Franke, A.C., Singh, S., Mc Roberts, N., Nehra, A.S., Godara, S., Malik, R.K., & Marshall, G. (2007). *Phalaris Minor* seed bank studies: Longevity, seedling emergence and seed production as affected by tillage regime. *Weed Research,47*, 73-83.

Kumar, A., Chand, R., Fulzele, R.M., & Singh, R. (2006). Impact of zero tillage technology intervention under IVLP on wheat cultivation. *Indian Journal of Extension Science, 1*(1), 19-22.

Kumar, A., Singh, R., Dar, R.S., Singh, S., Gathala, M.K., & Pathania, K. (2006a). Multidimensional impact assessment of zero tillage technology on wheat productivity in Haryana. *Journal of Food, Agriculture & Environment, 14*(2),85-90.

Kumar, A., Singh, R., Singh, S., Sendhil, R., Chand, R., & Pandey, J.K. (2017). Impact of resource conservation technologies in Haryana. *Journal of Community Mobilization and Sustainable Development*, 12(2), 257-264.

Kumar, A., Singh, R., Singh, S., Sendhil, R., Chand, R., & Pandey, J.K. (2017a). Adoption of resource conservation technologies and its impact on wheat cultivation in Haryana. *Indian Journal Extension Education, 53*(1), 45-54.

Sharma, R.K., Tripathi, S.C., Kharub, A.S., Chhokar, R.S., Mongia, A.D., Jag Shoran, Chauhan, D.S., & Nagarajan, S. (2005). *A decade of research on zero tillage and crop establishment*. Directorate of Wheat Research, Karnal Research Bulletin No. 18, 36.

Singh, R., Kumar, A., & Chand, R. (2007). Accelerating adoption of zero tillage technology. *Indian Research Journal of Extension Education, 7*(1),6-10.

Singh, R., Kumar, A., & Chand, R. (2009). Farmer's satisfaction level with aero tillage technology. *Journal of Community Mobilization and Sustainable Development, 4*(1), 1-5.

Singh, R., Kumar, A., Chand, R., Singh, S., Sendhil, R., & Sharma, I. (2016). Weed management strategies in wheat adopted by farmers in Punjab. *Journal of Community Mobilization and Sustainable Development, 11*(1),80-87.

Singh, R., Kumar, S., Kumar, A. Anuj, Ramesh Chand, R., & Singh, S. (2008). Multi-dimensionalimpact assessment of zero tillage technology. *Indian Journal of Agricultural Research, 42*(1),13-18.

Singh, R., Kumar, A., Kumar, S.,Chand, R., & Singh, S. (2006). Participatory research on effect of tillage option on wheat productivity. *Indian Journal of Journal Extension Science, 1*(1), 106-109.

Singh, R. & Kumar, S. (2005). Effect of resource conservation technologies on weed dynamics, pest and wheat productivity. In R.K., Malik, R.K., Gupta, C.M. Singh, C. M., A. Yadav, A., S.S. Brar, S. S., S.S. Thakur, S.S. S. S. Singh, S. S., R. Singh, R., & R.K. Sinha, R. K. (Eds). *Accelerating adoption of resource conservation technologies in rice-wheat systems of Indo-Gangetic Plains*., Directorate of Extension Education, CCSHAU, Hisar, Haryana, India, 224-228.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 83-86
DOI: 10.5958/2322-0430.2018.00040.9

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Recommended Technology is Boon or Bane for Cotton Crop in Punjab

G.S. Romana and Sanjeev Kumar Kataria

PAU, Regional Station Bathinda, FASC Noormahal

Corresponding author's email:

Received: January 15, 2018 *Manuscript Number: NS-18-89* *Revision Accepted: March 10, 2018*

ABSTRACT

To assess the performance of recommended technology at farmer's field an economic study was carried out on 100 farmers selected from 7 blocks of cotton belt of the state. The study revealed that during 2015 only 81.15 percent area of selected farmers followed the recommended time of sowing which subsequently increased to 95.58 percent during 2016. Similarly, 15.3 percent increase in adoption of recommended Bt hybrids was reported in 2016 over 2015. The data suggested that only 40 and zero percent of selected farmers followed the recommended dose of Nitrogen and Potassium Nitrate (KNO_3) fertilizers in 2015, whereas this level increased to 67 percent and 50 percent, respectively after the campaign during 2016. Further as per the use of recommended insecticides is concerned, the investigation reported that only 23 percent of the farmers used up to 6 recommended insecticides during 2015 which increased to 91 percent in 2016. So present study gives a clear indication that campaign to revive the cotton crop in Punjab played an important role and increased the cotton yield from 195 kg per hectare in 2015-16 to 756 kg per hectare during 2016-17, which is a record production all the time in the country. The study further revealed that the recommended technology played a vital role in the uplifting of cotton yield and proved as a boon for the cotton growers of Punjab.

Keywords
Cotton, recommended technology, fertilizers, yield.

JEL Codes
O32, Q01, Q10, Q12, Q16.

INTRODUCTION

Cotton *(Gossypium* species L.), an important *kharif* crop popularly known as "White Gold" is an extensively studied crop and is the chief source of natural fibre worldwide (Riaz *et al.*, 2013). The crop is of great economic importance as it plays a vital role in the agricultural and industrial development and enables to earn foreign exchange through export of its raw materials as well as finished products (Tuteja, 2014). Further Bt cotton adoption has increased aggregate employment, poverty reduction and rural development in India (Subramanian & Qaim, 2010). Cotton productivity is influenced by many abiotic and biotic factors. Abiotic factors are mainly concerned with environment whereas biotic factors are related to insect-pest and diseases. During the whole growing period of the crop, attack of 1326 insect-pests has been estimated, which results in heavy quantitative and qualitative losses to the crop (Manjunath, 2004). For the control of the insect-pests, farmers depend on the use of chemical control (Arif *et al.*, 2007) leading to increase in the cost of production, reducing the population of natural enemies of the pest, development of pesticide-resistant races of the pest and environmental pollution. One of the most hopeful ways to improve cotton productivity and quality is to grow resistant varieties, which is very efficient, inexpensive, economical and environmentally friendly approach (Pedigo, 1989; Ashok *et al.,* 2012). Host plant resistance acts as an effective tool for controlling the insect pests by enabling the plant to avoid, tolerate or recover from insect-pest attack (Pedigo, 1996). Over the years, many Bt and non-Bt varieties and hybrids of cotton have been introduced. These commercialized transgenic Bt cotton cultivars though resistant to bollworm attack but are highly vulnerable to sucking insect-pests (Kranthi *et al.*, 2005). Among sucking pests, whitefly (*Bemisia tabaci* Genn. Homoptera: Aleyrodidae) plays an important role by sucking a large number of plant juices (Oliveira *et al.*,

2001). It also causes indirect loss by secreting honeydew, closing respiratory pores, enhancing the growth of sooty mold fungus and reducing the process of photosynthesis. Most importantly, it acts as a vector of some dangerous plant viruses, which are acquired and transmitted between plants through this insect. Cotton is a highly sensitive crop and its productivity always remained volatile over the period of time. Huge loss of cotton crop had been observed in Punjab due to the menace of whitefly during 2015 and Punjab government had to spend ₹735 crore as compensation. So the present study was carried out to investigate the potential of recommended technology at farmers' field of *south-western region of Punjab.*

MATERIAL AND METHODS

Survey Sample

The survey was conducted in 7 blocks of Bathinda, the central district of cotton belt of Punjab, for two consecutive years, 2015-16 and 2016-17. In this study, a sample of 100 farmers was selected in 2015 whereas 80 farmers were formed in the year 2016. To evaluate the potential of recommended technology in cotton field viz., date of sowing, growing of recommended or un-recommended Bt hybrids, application of recommended dose of fertilizers, spray of recommended or un-recommended pesticides, etc. The survey sample has been elaborated in the following table:

Data Recording

The area sown: During the survey, a window of four-time of sowing was framed to observe the interest of farmers in this practice during both the years. The first window was kept from 16-30 April, subsequently; 1-15 May, 16-31 May and 1-15 June were kept as 2nd, 3rd, and 4th window. In this study, the area is sown under recommended hybrids and *desi* varieties along with un-recommended hybrids are also taken into consideration.

Fertilizer application: Four important nutrients viz., nitrogen, phosphorous, potash (KNO3) and zinc were evaluated at different doses the details of which are given below:

Spray of micro-nutrients and insecticides: Three to four sprays of potassium nitrate @ 2 kg per acre are recommended for the cotton crop by Punjab Agricultural University, Ludhiana. To investigate the spray schedule of potassium nitrate, 1 to 5 sprays were taken into consideration. Besides micronutrient sprays, the number of sprays carried out throughout the season was also recorded. To record the number of insecticides spray, ten categories from 0 to more than 8 were used.

Table 2. Fertilizer application format by the sample cotton farmers

(Kg/acre)

Nitrogen	Phosphorus	Potash	Zinc
Quantity (Kg/acre)	Quantity	Quantity	Quantity
0-15	Nil	Nil	Nil
15-30	5-10	1-10	1-5
30-45	10-15	10-20	**5-10***
45-60*	15-20	**20-30***	>10
60-75	**20-25***	30-40	Total
>75	25-30	41-50	
Total	Total	Total	

The*range includes recommended the dose of fertilizers.

Crop damage: On visual observation, the crop damage was assessed. This data includes the complete damage caused due to weather as well as insect pests and diseases.

Statistical Analysis

The data recorded was subjected to analysis with CPCS1 software developed by Department of Mathematics and Statistics, Punjab Agricultural University, Ludhiana. The mean and percent value was calculated for finding the significance of the recorded data.

RESULTS AND DISCUSSION

Area Sown: The results revealed that most of the sampled farmers sown the cotton cultivars during the recommended time period and only 82.5 acres were sown in the third window i.e. 16-31 May during 2015. Another major constraint observed during 2015 survey that maximum (82 percent) area was under un-recommended hybrids/genotypes and only 18 percent area was under recommended hybrids. No farmer from the selected sample opted for the cultivation of Desi cotton varieties/hybrids. During 2016, an extensive campaign was conducted that changed the whole scenario. The

Table 1. Sample detail of the study during 2015-16 and 2016-17

2015-16			2016-17		
Block	**Villages**	**Farmers**	**Block**	**Villages**	**Farmers**
Bathinda	3	19	Bathinda	8	44
Bhucho	3	9	Bhucho	3	11
Rampura	6	8	Rampura	2	5
Maur	3	9	Maur	1	5
Talwandi Sabo	3	12	Talwandi Sabo	4	10
Goniana	2	7	Goniana	1	5
Sangat	8	16	Sangat	9	20
	28	80		28	100

maximum area was sown during the recommended time of sowing i.e. in first two windows (16 April to 15 May) and total area under recommended hybrids also increased from 18 to 70.66 percent (Table 3) in 2016. So from this study, it can be concluded that if the farmers follow the recommended time of sowing and grow recommended Bt hybrids the productivity can be increased many folds.

Recommended Dose of Fertilizers: The data presented in Table 4 showed 9 percent increase in the farmer's number who had opted the recommended dose of nitrogen to the cotton crop during 2016 (59 percent) over the previous year 2015 (50 percent). On the other side, the recommended dose of phosphorous was applied by 29 percent of the farmers during 2016 as compared to 35 percent in 2015. Similar observations were recorded in the used dose of potash. This shows that following the recommended package of practices by the selected farmers resulted in fetching good yield and less crop damage by the insect pests and diseases. One interesting fact came to light that selected farmer also opted for the use of Zn to their soils and 1.25 percent increase in the adoption of the recommended level of Zinc was noticed in this study.

Reduction in Insecticides Spray: In this study, a schedule of 0 to more than 8 insecticides was followed. During 2015, it was recorded that most of the selected farmers applied six (10 percent), seven (13 percent), eight (15 percent) and more than eight (29 percent) sprays of different un-recommended insecticides to cotton crop (Table 5). After the campaign during 2016, the selected farmers gave only four sprays (41 percent) and five sprays (33 percent) of recommended insecticides. So, this study concluded that if the farmers monitor his cotton crop regularly and sprayed the recommended insecticides at the economic threshold level, the number of sprays can decrease significantly.

The Spray of Potassium Nitrate (KNO_3): As per recommendation 3 to 4 sprays of potassium nitrate at flowering stage in cotton are must enhance its yield. During 2015, 85 percent farmers not used this recommendation whereas five percent farmers gave one spray and 10 percent opted only two sprays during the flowering stage. After campaign during 2016, this percentage increased and 43 percent farmers gave three sprays during flowering stage and 4 percent applied four sprays of potassium nitrate (Table 6). Another interesting observation came to light that only 19 percent farmers didn't use any spray of KNO_3 whereas this percentage was as high as 85 during 2015.

Crop Damage: In this study on the basis of visible damage to the cotton crop, four categories for the extent of damage were kept. The damage to cotton crop recorded in this study was the gross damage caused due to insect pests attack, disease incidence, and climatic conditions. During 2015, maximum (75 percent) damage was recorded in which more than 75 percent cotton crop was badly affected (Table 7). Only 4 percent farmers had managed the insect pests and diseases during 2015. After the campaign in 2016, the farmers became more vigilant and aware regarding insect pests and diseases attack and they managed the same well in time. So, during 2016, 92.5 percent farmers had their cotton crop in a very good condition and none of the farmers faced more than 75 percent loss to his cotton crop.

CONCLUSIONS

From this study, it can be concluded that the

Table 3. The area in acres under recommended, Desi and un-recommended cotton genotypes during different sowing periods

Variety/hybrids	16-30 April		1-15 May		16-31 May		1-15 June		Percent area	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
Recommended hybrids/varieties from SAU	3	75.25	76	123.5	0	10.25	0	3	18	70.66
Desi varieties	0	16	0	5.5	0	0	0	0	0	7.17
Un-recommended hybrids/genotypes	0	16	276.25	50.5	82.5	0	0	0	82	22.17

Table 4. Percent of farmers follow recommended the dose of Fertilizer in cotton

Nitrogen (Kg/acre)	2015	2016	Phosphorous (Kg/acre)	2015	2016	Potash (kg/acre)	2015	2016	Zn (Kg/acre)	2015	2016
0-15	1.25	1	Nil	10	20	Nil	**70**	**85**	**Nil**	80	82
15-30	8.75	10	5-10	3.75	10	10-20	3.75	0	5-10	10	4
30-45	5	18	10-15	42.5	36	20-30	1.25	0	**10-15**	**8.75**	**10**
45-60	**50**	**59**	15-20	3.75	3	20-30	20	9	15-20	1.25	4
60-75	22.5	12	**20-25***	**35**	**29**	30-40	1.25	1			
>75	12.5	0	25-30	5	2	41-50	3.75	5			

Table 5. Percent reduction in the number of insecticide/ pesticides sprays during 2015 and 2016

No. of spray	2015	2016
0	0	0
1	0	0
2	0	3
3	2	8
4	**5**	**41**
5	**6**	**33**
6	10	8
7	13	5
8	15	2
>8	29	0

Table 6. Percent increase in number of sprays of potassium nitrate by the sample farmers

Number of sprays	2015	2016
0	**85**	**19**
1	5	12
2	10	22
3	**0**	**43**
4	**0**	**4**
5	0	0

Table 7. Crop damage due to various factors viz, insect pests, diseases and climate

Extent of damage (percent)	2015	2016
Up to 25	4	92.5
25-50	13	6.25
50-75	8	1.25
>75	75	0

recommended technology for the cotton crop in the state has the potential to achieve a record level of production with the available resources. Though abiotic factors highly target the sensitivity of the crop, the biotic stress can be easily managed by the proven technology. The adoption of recommended technology improves the production as well as economics from the cotton crop (Gandhi & Namboodiri, 2006; Qaim *et al* 2006. Thus, if the farmers remain vigilant from the insect pests attack, monitor their fields regularly, use recommended the dose of fertilizers and insecticides then a significant level of production can be assured.

ACKNOWLEDGEMENT

Authors are thankful to Head, Department of Economics & Sociology, Punjab Agricultural University Ludhiana to facilitate us by providing all the necessary input. Thanks are also due for Dr. J.S. Sidhu, Senior Farm Economist for reviewing the manuscript.

REFERENCES

Arif, M.J., Abbas, G., & Saeed S. (2007, March 24). Cotton in danger. *The Dawn, The Internet Edition*, pp. 4.

Ashok, K.R., Uma, K., Prahadeeswaran, M., & Jeyanti, H. (2012). Economic and environmental impact of Bt cotton in India. *Indian Journal of Agricultural Economics, 67*(3), 405-429.

Gandhi, V.P., & Namboodiri, N.V. (2006). *The adoption and economics of Bt cotton in India*. IIM Institutional Repository. Retrieved from hhttp://hdl.handle.net/11718/187

Kranthi, K.R., Kranthi, S., Ramesh, K., Nagrare, V.S., & Barik, S. (2005). *Advances in cotton IPM* (Technical Bulletin). Central Institute for Cotton Research. Post Bag No. Shankar Nagar, PO, Nagpur (MS), India.

Manjunath, T.M. (2004). Bt cotton in India. In The technology wins as the controversy wanes. Retrieved from *www.monsanto.co.uk/newsukshowlib.html?wid+8478*.

Oliveira, M.R.V, Henneberry, T.J., & Anderson, P. (2001). History, current status and collaborative research projects for *Bemisia tabaci. Crop Protection*, *20*(9), 709-723.

Pedigo, L.P. (1989). *Entomology and Pest Management*. New Delhi: Prentice Hall of India (Pvt.) Ltd.

Pedigo, L.P. (1996). Plant resistance to insects. In *Entomology and Pest Management,* (pp. 413-424). New Delhi: Prentice Hall of India Private Limited.

Qaim, M., Subramanian, A., Naik, G., & David, Z. (2006). Adoption of Bt cotton and impact variability: Insights from India. *Applied Economic Perspective and Policy, 28*(1), 48-58

Riaz, M., Naveed, M., Farooq, J., Farooq, A., Mahmood, A, Rafiq, ..., Sadiq A. (2013). AMMI analysis for stability, adaptability and GE interaction studies in cotton (*Gossypium hirsutum* L.). *Journal of Animal Plant Science*, *23*(3), 865-871.

Subramanian, A., & Qaim, M. (2010). The impact of Bt Cotton on poor households in rural India. *The Journal of Development Studies*, *46*(2), 295–311. http://doi.org/10.1080/295.311

Tuteja, O.P. (2014). Studies on heterosis for yield and fibre quality traits in GMS hybrids of upland cotton (*Gossypium hirsutum* L.). *Journal of Cotton Research and Development, 28*(1), 1-6.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 87-95
DOI: 10.5958/2322-0430.2018.00041.0

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Water and Energy Use Efficiency of Maize vis-à-vis Paddy Crop in Punjab Agriculture: A Move towards Crop Diversification

Yugraj Singh[1] and Baljinder Kaur Sidana[2]*

M.Sc. Student, and Assistant Economist (QM) Department of Economics and Sociology
Punjab Agricultural University, Ludhiana-141004 (Punjab)

[*]Corresponding author's email: yuvidhillon0009@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-90* *Revision Accepted: March 19, 2018*

ABSTRACT

The present study examines the resource use efficiency of maize vis-à-vis paddy across various farm size categories in Punjab. In order to accomplish the objective of the study, primary data was collected from the sample of 100 farmers (40 small, 40 medium and 20 large) who cultivate maize as the main season crop (kharif crop) and grow paddy as well from 28 villages of two districts of Punjab namely Hoshiarpur and Roopnagar through multistage purposive sampling technique. The results showed that on an average 5 irrigations was applied to maize crop on the contrary 22 irrigations to paddy were applied in the study area, showed water-intensive nature of the crop, which resulted in the downfall f 5.7 m water level in the sample villages in the last decade. Though the per hectare net return of maize crop (₹27987.70) was less than that of paddy (₹38001.10) but if the irrigation cost of pumping out groundwater is included in the operational cost, the returns would have been decreased by 8.43 percent of maize crop and 23.44 percent for paddy crop from the existing net returns among the sample farmers. The Cobb Douglas production function was used to estimate the elasticity coefficients of different inputs determining the crop productivity. The results showed that, in maize only seed and in paddy, the plant protection, urea, DAP, and water-use were statistically significant having positive regression coefficients.

Keywords
Energy use, efficiency, maize, diversification.

JEL Codes
O13, Q16,Q42, Q43.

INTRODUCTION

Rice in the *kharif* season and wheat in the *rabi* season dominate the cropping pattern of the state brought farming in critical juncture, resulting in various ecological, environmental and soil-related problems. Paddy crop is highly water-intensive crop, as it consumes 3,000 liters of water to produce one kilo of rice (Saran *et al*., 2013). Thus, the sustainability of agriculture in state is under threat. In order to revitalize Punjab agriculture through exploring alternatives to the rice-wheat system, various expert committees and other groups (Johl Committee, 2002; Alagh Committee, 2005; Government of Punjab, 2006) have recommended the diversification of agriculture towards high-value commodities and a broader mix of traditional commodities and agro-processed products that augment farm income, promote exports and conserve soil and water resources. Underlying the importance of diversified agriculture, it has been observed that the Punjab state has large potential for cultivation of a variety of high-value crops as well as related enterprises. Recently, Punjab government has submitted a diversification plan to the Union government for shifting 12 lakh hectares of paddy area to other crops like maize, cotton, sugarcane, agro-forestry, pulses, fruits, and vegetables in the *kharif* season. For this purpose, the funds demanded by the State Government from Union Government are worth about ₹5000 crores. Maize is one of the best alternate crops, as the profits in Maize-Potato-Wheat rotation come after Paddy-Potato-Wheat rotation (Kaur & Kaur, 2012). The per hectare irrigation water use of paddy varies from 9000 m^3 to 14000 m^3 depending upon water table depth and installed capacity of groundwater abstraction structures at that place, whereas for maize, other cereals, pulses and oilseeds it varies from

2000 m^3 to 3500 m^3; the water use of paddy being three times higher than that of wheat and five to six times higher than that of pulses and oilseeds. The rice crop being grown on an area of 28.94 lakh ha in Punjab has created a serious depletion of groundwater resources. Furthermore, the maximum water table depth has declined particularly in Central Punjab and most of the development blocks have been categorized as 'dark', where no extra bore well can be permitted (Sidhu *et al*., 2010). Moreover, the fall in water table depth by 9.86 m in the central districts of the state is mainly attributed to 68 percent increase in paddy area (Kaur, 2011). Additionally, in 1984 the proportion of over- exploited blocks was 45 percent which swelled to 78.98 percent in 2011. The white blocks which were 30.5 percent in 1984 decreased to only about 15 percent in 2011 (Kaur *et al.,* 2015).

Maize (*Zea mays*) is one of the most important cereal crop worldwide; not only for human consumption but also for animal consumption. The crop is an important staple food for more than 1.2 billion people in Sub-Saharan Africa and Latin America and a key food crop in Asia. About 28 percent of the maize produced in India is consumed directly as food and others like popcorn, ethanol, baby corn, flour, and cornflakes. Eleven percent of maize is consumed as animal feed, 48 percent as poultry feed, 11 percent as starch, 1 percent as brewery and 1 percent as seed. The maize is cultivated throughout the year in all states of the country for various purposes including grain, fodder, green cobs, sweet corn, baby corn, and popcorn.

Punjab unlike the rest of India had traditionally been a maize growing state until rice became popular. Area under maize cultivation declined since 2006-07 with little improvement in the yield. In 1970-71, the area under maize cultivation was approximately 5.55 lakh hectares. Ever since, the area under maize has been continuously declining (Economic Advisor, 2014). The long-term goal of the Department of Agriculture, Punjab (DoAP) is to bring at least 5.55 lakh hectares once again under maize cultivation in the state over the next five years. Its immediate target was to bring 1.5 lakh hectares under maize cultivation in 2013-14. Encouraged by the healthy profits made in 2012-13, farmers sowed maize crop in double the target area in 2014. But in spite of the bumper production, farmers did not receive the expected returns this year (Vashisht, 2014).

The agricultural policy reflects the potential of maize crop as the future crop of Punjab, becoming the most suitable replacement for paddy. This increase is likely to result in production increase from 0.5 million tonnes to 2 million tonnes. The maize cultivation in the state is facing certain constraints which have proved detrimental to the growth of maize crop in Punjab. It has been found that cost of cultivation of maize is lower than the rice in the state but productivity of maize could not keep pace with the productivity of rice. In the backdrop of this, the present study was initiated to examine the cost of production of maize vis-a-vis paddy in the state and to identify the production and marketing constraints, which hinder the growth of maize crop in the state.

METHODOLOGY

The study was confined to Punjab state. Multi-stage sampling technique was followed for the selection of the study sample. At the first stage, two districts with highest concentration of area under maize crop for the year 2014 was selected namely Hoshiarpur and Roopnagar. At the second stage, two blocks from each district were selected following the same criterion. Garhshanker and Banga blocks were selected from Hoshiarpur district and Shri Anandpur Sahib and NoorpurBedi blocks were selected from Roopnagar district respectively. At the third and last stage, 100 farmers were randomly selected from cluster of villages from each of these four blocks, keeping in view the objectives of the study that the selected farmers must be growing both the crops maize as well as paddy on his farm. The maize growers were selected purposively who cultivate maize as the main season crop (*kharif* crop) and grow paddy as well. Hence, a total of 100 farmers constituted sample size, choosing 25 farmers from each block. Based on NSSO (National Sample Survey Organization) categorization, farmers have been categorized as marginal (below 1 ha), small (1-2 ha), semi-medium (2-4 ha), medium (4-10 ha) and large (above 10 ha) category farmers. But in the present study, the farm-size categories were merged and henceforth termed as small category farmers (up to 2 ha), medium category farmers (2-10 ha) and large category farmers (above 10 ha) for further analysis. These farmers were interviewed personally and interview schedule was filled about their cropping pattern, input used and output obtained.

Resource-use Efficiency

To examine the factors affecting value productivity of maize crop. Cobb-Douglas function of the following form was considered the most appropriate for the present investigation and was fitted:

$$Y = A\prod_{i=1}^{n} X_i^{b_i} e^{u}$$

Where, Y represents the quantity of yield per hectare in quintals of maize crop under study, X_i the selected explanatory variables (per hectare). A the technical efficiency parameter and bi the coefficient of elasticity of production of the respective variable X_i at the mean level of input used and output obtained. The 'e' is an error term. The estimated form of the equation becomes:

$$\text{Log } Y = \text{Log } A + \sum_{i=1}^{n} b_i \log x_i + u$$

$$\text{Log } Y = \text{Log } A + b_1 \log x_1 + b_2 \log x_2 + \ldots\ldots\ldots\ldots + b_7 \log x_7 + u$$

Where

Y = Yield (q/ha)

X_1 = Seed (₹/ha)

X_2 = Human labour (hr/ha)

X_3 = Plant protection (₹/ha)
X_4 = Tractor use (hrs/ha)
X_5 = Urea (kg/ha)
X_6 = DAP (kg/ha)
X_7 = Water-use (m^3/ha)

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_i) 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_i

Coefficient of Multiple Determination(R^2)

The coefficient of multiple determination was worked out to estimate the proportion of variation in total output/gross returns per hectare explained by the different explanatory variables, taken together in analysis. Statistical significance of R^2, which examine 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^2 = Coefficient of multiple determinations
n = Number of observations
K = Number of parameters included in the study

The resource-use efficiency was examined on the basis of marginal value productivity (MVP), which indicated the increase in the returns from the use of an additional unit of a given input while keeping the level of other inputs constant. The marginal value productivity (MVP) of the ith input was calculated as following:

$$MVP = bi\left(\frac{\overline{Y}}{\overline{X}}\right)Py$$

Where,

bi = Regression coefficient of ith input
y^i= Geometric mean level of maize/paddy productivity per hectare
x_i= Geometric mean level of the ith input used
Py = Price of maize/paddy

Resource-use efficiency was studied by comparing the MVPs of each resource with corresponding factor cost.

Water Productivity

Water productivity and economic analysis combines physical accounting of water with yield or economic output to assess how much value is being obtained from the use of water (Abdullaev *et al.*, 2007). For this analysis, physical WP was calculated by equation (1):

WP=Output/Q …(1)

Where WP is the productivity of water in kgm^{-3}, output is the production of crop in kilograms and Q is water used by the crop (m^3). Total amount of water used in maize and paddy crop was calculated by multiplying the discharge from the tube-well bore with total time taken for irrigating the crop throughout the season (total irrigation hours multiplied by volume of water drawn out per hour by submersible pump). The volume of water drawn out by a submersible pump differed with the horsepower of the pump. The submersible motors having different horsepowers were brought to the same denominator by allocating the weight (discharge rate in liters per second) to different horsepower motors. The average water table depth was observed 31.5 m in the study area, accordingly discharge rates were applied, to different horsepower motors; to reach at the water-use figures of maize and paddy crop for the selected sample.

RESULTS AND DISCUSSION

Area under Maize Crop

The overall average operational holding with the sample farmers were 5.22 hectares in which only 1.31 hectares were under maize crop, which was about 25.10 percent to the average operational holding. Average area under maize crop was highest in the case of small farmers (33.33 percent) and lowest in large farmers (21.89 percent). It was because large farmers had more access to irrigation facilities, so that cultivate paddy crop on a large part of their operational holding leaving less share for maize, as the profits in the paddy crop was more as compared to maize crop. The small category farmers having limited access to irrigation water cultivated highest proportion of maize crop than other farmers (Table 1).

Cropping Pattern

Besides agro-climatic conditions, the resource endowment and the relative profitability of different enterprises also play a dominant role in determining the cropping pattern of an area. Thus, the cropping pattern

Table 1. Area under maize crop among the sample farmers, Punjab, 2014-15

Particulars	Farm size categories			Overall
	Small	Medium	Large	
Average Operational Holding	1.50	4.46	14.16	5.22
Average area under maize crop	0.50	1.22	3.10	1.31
Percent area under maize crop (2÷1)*100	33.33	27.35	21.89	25.10

might change overtime due to significant change in the relative profitability of different enterprises affected by new technology and the input-output prices. The size-wise cropping pattern of sample farmers can be seen in the Table 2. The following were the major crop rotations followed by the farmers in both the sample districts:

Rotation I: Paddy-Wheat
Rotation II: Maize-Potato-Wheat
Rotation III: Maize-Green Peas-Wheat
Rotation IV: Maize-Potato-Sarson
Rotation V: Maize-Potato-Spring Maize

In *kharif* season, paddy and maize both covered a sizeable portion of gross cropped area. Overall, paddy covered about 28.78 percent and maize about 11.86 percent of the total gross cropped area, respectively. Small-sized farmers covered more area under maize crop as compared to medium and large category farmers.

In *rabi* season, wheat was the major crop, it occupied about 37.74 percent of the total gross cropped area. Similarly, green peas also covered a sizeable portion of cropped area which was sown in September-October and harvested in the month of December, grown on about 4.80 percent of the total cropped area. Fodder occupied almost 4 percent of area in both the seasons, indicating the relative importance of dairy in cropping pattern. Hence, the cropping pattern on the sample farms was dominated by wheat in *rabi* and paddy and maize in *kharif* season.

Status of Water Level

The average underground water depth in the sample villages was 25.8 m in the year 2004, 31.5 m in 2014 (Table 3). In 2004, about 76 percent of the sample farmers reported that their average groundwater depth is less than 20 m, whereas, in 2014, only 53 percent of the sample farmers reported that their average water table depth is less than 20 m. In 2014, 12 percent of the farmers had water level depth below 50 m whereas no farmer in the sample study was below 50 m depth in 2004. Such a drastic change in groundwater level from 25.8 m in 2004 to 31.5 m in 2014 was due to the reason, that most of the cropped area was under paddy crop. The groundwater abstractions structures like electric motors have been replaced by submersible pumps in the area and presently the irrigation structure inventory with the sample farmers comprised 61 percent of submersible pumps, 36 percent of centrifugal pumps, 25 percent of diesel engines and 21 percent of generators.

Comparative Cost and Return Structure of Maize and Paddy Crop

The operational cost of maize and paddy crop was compared to visualize the savings in cost if maize is grown instead of paddy crop. The perusal of Table 4 clearly revealed that cost of seed was much more in maize cultivation than paddy crop, about more than double with the sample farmers. A difference of ₹1773.22 was observed, whereas cost of urea, hired tractor was little bit more in maize cultivation as compared to paddy crop. On the other hand, operational cost incurred on DAP, MOP, plant protection, human labour-use and tractor use was much higher in paddy crop. A savings of ` 15728.70 per hectare in operational cost was realized in cultivating maize instead of paddy crop in which a major part of cost was realized on human labour-use (₹8650 per ha).

The overall average production (yield) of maize crop and paddy crop came out to be 50.14 quintals and 62.76 quintals per hectare respectively (Table 5). Thus the overall gross returns came out to be ₹58809.95 per hectare in maize crop and ₹84552.05 per hectare in paddy crop. It was only because of the assured prices, high MSP, developed market infrastructure in the case of paddy than maize which leads to more returns than maize. On the other side, there was no procurement of maize grain, MSP was setup by the government but most of the farmers didn't get remunerative price for their crop in market, fluctuations in prices and yield, etc., which led to low

Table 2. Cropping pattern among the sample farmers, Punjab, 2014-15

(Per hectare)

Crops	Farm size categories			Overall
	Small	Medium	Large	
Kharif season				
Paddy	0.71 (21.91)	2.72 (30.09)	9.35 (31.11)	3.18 (28.78)
Maize	0.50 (15.43)	1.22 (13.50)	3.10 (10.32)	1.31 (11.86)
Sugarcane	0.00 (0.00)	0.17 (1.88)	0.69 (2.30)	0.20 (1.81)
Fodder	0.24 (7.41)	0.43 (4.76)	1.22 (4.06)	0.51 (4.62)
Others*	0.05 (1.54)	0.00 (0.00)	0.00 (0.00)	0.02 (0.18)
Rabi season				
Wheat	1.16 (35.80)	3.55 (39.27)	11.36 (37.80)	4.17 (37.74)
Spring maize	0.01 (0.31)	0.38 (4.20)	1.28 (4.26)	0.43 (3.89)
Fodder	0.25 (7.72)	0.01 (0.11)	0.98 (3.26)	0.46 (4.16)
Green peas	0.23 (7.10)	0.36 (3.98)	1.46 (4.86)	0.53 (4.80)
Potato	0.04 (1.23)	0.16 (1.77)	0.55 (1.83)	0.19 (1.72)
Others*	0.05 (1.54)	0.04 (0.44)	0.06 (0.20)	0.05 (0.45)
Gross cropped area	3.24 (100.00)	9.04 (100.00)	30.05 (100.00)	11.05 (100.00)

Figures in the parentheses are percentages to the total gross cropped area (GCA).
****Others include area under kinnow orchards, eucalyptus and popular in kharif season and in rabi season, it includes area under oilseed crops like mustard.***

profitability of maize crop.

The returns over variable cost in maize came out to be ₹27987.70 per ha whereas in the case of paddy it was ₹38001.10, depicting lower net returns in maize than paddy.

Had the electricity being given free to Punjab farmers for irrigating the paddy crop been charged by the Punjab government, the irrigation cost would have been ₹7216.88 for paddy crop and ₹2177.04 for maize crop; making variable cost of ₹53767.83 for paddy and ₹32999.29 for maize. Then net returns would have been decreased to 8.43 percent in the case maize crop and 23.44 percent in the case of paddy crop respectively from overall existing returns among the sample farmers.

Moreover, the burning of stubbles (by-product) of paddy crop emits a lot of methane gas which increases global warming, whereas the by-product of maize is used as a fodder for livestock. The overall benefit-cost ratio of 1.91 in the case of maize and 1.82 in the case of paddy crop was realized. It was more in the case of maize crop as

Table 3. Status of groundwater level of sample farmers, Punjab, 2014-15

Water level (m)	At present		10 years ago	
	Number	Average depth of water level (m)	Number	Average depth of water level (m)
⊴0	49 (49.00)	7	56 (56.00)	4
>10-20	4 (4.00)	18	20 (20.00)	14
>20-30	20 (20.00)	25	19 (19.00)	27
>30-40	6 (6.00)	37	4 (4.00)	38
>40-50	9 (9.00)	46	1 (1.00)	46
>50	12 (12.00)	56	0 (0.00)	-
Average depth		31.5		25.8

Figures in the parentheses are percentages to the total sample size.

Table 4. Comparative cost structure of maize crop vis-à-vis paddy crop among sample farmers, Punjab, 2014-15

(₹per ha)

Particulars	Paddy (i)	Maize (ii)	Savings in cost (III)=(i)-(ii)
Cost of seed	1560.05	3333.27	-1773.22
Fertilizers			
Urea	1513.37	1653.48	-140.11
DAP	3828.44	3259.37	569.07
MOP	442.62	61.44	381.18
Micro nutrients	1420.99	210.57	1210.42
Irrigation charges*	797.24	0.00	797.24
Agri chemical/weedicides	3370.32	1799.40	1570.92
Human labour			
Hired labour	12961.08	10935.21	2025.87
Family labour	9039.00	2414.25	6624.75
Tractor			
Own tractor	2213.80	1592.01	621.79
Hired tractor	3278.64	3690.18	-411.54
Cost of combine harvesting	3187.47	0.00	3187.47
Marketing cost	933.29	545.80	387.49
Interest @ 9 percent per half of the period of crop on variable cost	2004.59	1327.27	677.32
Total variable cost	46550.95	30822.25	15728.70

Irrigation charges include value of diesel oil consumed for irrigation.

compared to paddy crop.

Resource-use Efficiency of Maize and Paddy Crop across Different Farm Size Categories

The Cobb-Douglas production function was employed to the data in order to obtain frontier for various farm size categories. Table 6 depicts the regression analysis results of the Cobb-Douglas production function fitted for yield on various farm size categories in the study area.

The value of R^2 presented in the Table 6, showed that the included explanatory variables collectively explained about 36 percent variation in yield on small farms whereas this percentage was 57 in the case of large farms. Thus, there was 32 percent variation in per hectare productivity of maize crop was explained by the explanatory variables included in the model filled for this study, rest 68 percent remained unexplained. This was due to the reason that yield of maize crop not only depends on the inputs used but also on the other factors such as time of sowing, variety chosen, weather, type of soil, fertility status of soil and proper irrigation scheduling, etc. which were not included in the model.

In overall sample size, the productivity of the maize cultivation was positively related to the seed and human labour, as the regression coefficients of seed has 0.142 and human labour has 0.097, significant at 1 and 10 percent level respectively. In the case of small farms, the productivity of maize cultivation was positively related to coefficient of seed (0.157) and human labour (0.453) whereas negatively related to plant protection (-0.153). On the medium and large farms, the role of seed was positive and highly significant. The coefficient of seed in the case of medium and large farms was 0.181 and 0.082 respectively, which means with one percent increase in the use of seed, the yield will increase by 0.181 and 0.082 percent respectively.

Table 5. Comparative return structure of maize and paddy crop of different farm size categories, Punjab, 2014-15

(₹ per ha)

Particulars	Maize				Paddy			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall
Yield (q/ha)	44.09	51.81	58.91	50.14	59.34	62.90	69.28	62.76
Value of output (Main product)	47352.99	56341.93	62015.53	53881.07	79962.85	84778.43	96946.88	84552.05
Value of straw (By-product)	4835.02	4949.26	5075.85	4928.88	0.00	0.00	0.00	0.00
Gross returns	52188.01	61291.19	67091.38	58809.95	79962.85	84778.43	96946.88	84552.05
Variable cost	29887.49	29487.03	32471.36	30822.25	47242.53	44672.33	48709.48	46550.95
Returns over variable cost	22300.52	31804.16	34620.02	27987.70	32720.32	40106.10	48237.40	38001.10
Benefit-cost ratio	1.75	2.08	2.07	1.91	1.69	1.90	1.99	1.82

Table 6. Coefficients of production function (log-linear) for maize on different farm size categories in Punjab, 2014-15

Variables	Farmer categories			Overall
	Small	Medium	Large	
Intercept	1.458	3.057***	-0.940	1.874*
	(1.241)	(1.088)	(2.080)	(0.811)
Seed (₹/ha)	0.157*	0.181***	0.082***	0.142***
	(0.070)	(0.061)	(0.108)	(0.043)
Human labour (hr/ha)	0.453*	-0.064	-0.124*	0.097*
	(0.236)	(0.171)	(0.379)	(0.145)
Plant protection (₹/ha)	-0.153*	0.016	0.573*	0.033
	(0.089)	(0.092)	(0.190)	(0.059)
Tractor use (hr/ha)	0.001	-0.139*	0.054	-0.067
	(0.081)	(0.066)	(0.130)	(0.051)
Urea (kg/ha)	-0.092	-0.010	0.225*	0.036
	(0.097)	(0.063)	(0.205)	(0.057)
DAP (kg/ha)	0.058	-0.036	-0.076	-0.005
	(0.113)	(0.058)	(0.140)	(0.047
Water-use (m^3/ha)	0.010	0.031	-0.052	0.016
	(0.041)	(0.025)	(0.055)	(0.022)
R^2	0.36	0.47	0.57	0.32

******, **, and * Significant at 1,5, and 10 percent level.***
Figures in the parentheses indicate the standard error.

In order to evaluate the economic efficiency of the farmers as users of resources, the marginal value productivity was compared to their respective prices. The basic criterion of an efficient resource is that ratio of marginal value product of a factor to the factor cost is equal to one. A ratio of greater than one indicates that the returns could be increased by using more of that resource and the ratio less than one indicates the unprofitable use of that resource which should be reduced to increase profit or gross margin. In order to examine the resource-use efficiency by different farm size categories as well as overall sample size, for maize crop, the ratios of marginal value productivity of each resource was compared to the respective factor cost to indicate the allocative efficiency or inefficiency of sample farmers.

It is evident from the Table 7 that on small farms, the ratio of MVP to MFC of seed and human labour was found to be significantly positive above unity (2,70 and 1.98), indicating underutilization of these resources whereas for plant protection on small farms the ratio was found to be negative indicating the excessive and uneconomical use of this input which could be decreased to increase the profit on small farms. Similarly, on medium farms, the ratio of MVP to MFC for tractor use is negatively significant meaning thereby that the last unit of capital spent on tractor-use has resulted in loss.

In the case of large farms, it was the seed and plant protection for which the ratios of MVP to factor cost were found to be significantly greater than unity, indicating the sub-optimal use of this resource which could be increased for greater returns, thereby achieving the equilibrium level of input use to become allocative or price efficient. For the overall sample, ratio of MVP to MFC for seed, that is, the price efficiency of seed was found to be significantly above unity which clearly indicates that the more use of hybrid seed will increase gross returns on the farm, as yield of maize crop greatly depends on the quality of seed used on the farm (Table 7).

Table 7. Ratios of marginal value productivities of resources to their factor costs on different categories of maize farms, Punjab, 2014-15

Variables	Farm categories			Overall
	Small	Medium	Large	
Seed	2.70*	3.09***	1.34***	2.35**
Human labour	1.98*	-0.29	-0.50*	0.41
Plant protection	-4.71*	0.50	17.38*	1.01
Tractor use	0.01	-2.57*	1.01	1.00
Urea	-3.02	-0.34	7.60*	1.22
DAP	0.99	-0.63	-1.28	0.09
Water-use	0.31	1.10	-1.74	0.53

******, **, and * Significant at 1, 5 and 10 percent level.***

The analysis showed (Table 8) that productivity of the paddy cultivation was positively related to the plant protection and urea in the case of small farms, as the regression coefficients of the plant protection and urea came to be positive and significant at 5 and 1 percent level, respectively. In medium farms, human labour was found to be negative and urea was found to be positive and significant at 1 percent level respectively. In large farms, regression coefficients of human labour-use were negative (-0.530) which was highly significant, which implies that 1 unit increase I human labour hours will decrease the paddy yield by 0.53 percent. The value of R^2, presented in the Table 8, showed that the included explanatory variables collectively explained about 74, 82, and 94 percent variation in the per hectare productivity of paddy crop across small, medium and large farm size categories respectively.

Table 8. Coefficients of production function (log-linear) for paddy on different farm size categories in Punjab, 2014-15

Variables	Farmer categories			Overall
	Small	Mediu	Large	
Intercept	-0.796	4.060*	4.583*	2.132***
	(1.882)	(1.880)	(2.241)	(0.794)
Seed (₹/ha)	0.014	0.029	-0.026	0.009
	(0.131)	(0.108)	(0.099)	(0.071)
Human labour	-0.004	-0.363***	-0.530*	-0.243***
(hr/ha)	(0.178)	(0.106)	(0.224)	(0.086)
Plant protection	0.332*	-0.095	0.037	0.096**
(₹/ha)	(0.157)	(0.182)	(0.113)	(0.043)
Tractor use	-0.124	0.003	-0.063	-0.024
(hr/ha)	(0.080)	(0.032)	(0.067)	(0.025)
Urea (kg/ha)	0.365***	0.405***	0.097	0.334***
	(0.084)	(0.067)	(0.076)	(0.046)
DAP (kg/ha)	0.077	0.016	0.382***	0.106**
	(0.078)	(0.083)	(0.106)	(0.047)
Water-use	0.025	0.051	0.039	0.032*
(m^3/ha)	(0.039)	(0.031)	(0.025)	(0.019)
R^2	0.74***	0.82***	0.94***	0.80***

******, **, and * Significant at 1,5, and 10 percent level.***
Figures in the parentheses indicate the standard error.

In the case of paddy crop (Table 9), on small farms the ratio of MVP to MFC plant protection and urea, whereas on medium farms only urea and on large farms the ratio of DAP was positive and significantly greater than unity, indicating the sub-optimal use of this resource which could be increased for greater returns. On the other hand, human labour on medium and large farms was found to be negative and significantly different from unity, indicating the excessive and uneconomical use of this input which could be decreased to increase the profit. For the overall sample, ratio of MVP to MFC of plant protection, urea, DAP, and water-use was found significantly greater than unity whereas human labour was found significantly less than unity indicating the excessive use of this input in paddy crop.

Water Productivity and Energy Saving across Different Farm Size Categories of Maize vis-à-vis Paddy Crop

Groundwater is the highly over-exploited and inefficient used resource in the Punjab state primarily due to cultivation of paddy crop on large area. The water table has gone down drastically in Punjab and most of the development blocks have been categorized as 'dark'.

Table 9. Ratios of marginal value productivities of resources to their factor costs on different categories of paddy farms, Punjab, 2014-15

Variables	Farm categories			Overall
	Small	Medium	Large	
Seed	0.75	1.57	-1.41	0.49
Human labour	-0.02	-1.38***	-2.10*	-0.94***
Plant protection	8.42*	-2.40	0.93	2.42**
Tractor use	-0.98	0.03	-0.74	-0.23
Urea	20.58***	22.94***	5.44	18.80***
DAP	1.71	0.36	8.47***	2.35**
Water-use	0.29	0.63	0.47	0.39*

******, **, and * Significant at 1,5, and 10 percent level.***

Table 10. Water-use and productivity of maize crop and paddy crop across different farm size categories, Punjab, 2014-15

(Per ha)

Particular	Farmer categories		
	Small	Medium	Large
Maize			
Water-use of Maize (m^3)	2296.66	2481.87	2483.85
Yield of Maize(kg)	4409	5181	5891
Water Productivity(kg/m^3)	1.92	2.09	2.17
Paddy			
Water-use of Paddy (m^3)	9234.23	9189.18	10483.69
Yield of Paddy(kg)	5934	6290	6928
Water Productivity(kg/m^3)	0.64	0.68	0.66

Table 11. Water productivity and energy saving of maize vis-à-vis paddy crop among sample farmers, Punjab, 2014-15

Particular	Maize	Paddy	Difference (maize over paddy)
Water-use (m^3/ha)	2399.18	9426.10	-7026.92
Yield (kg/ha)	5014	6276	-1262
Water productivity (kg/m^3)	2.09	0.67	1.42
Energy-use (kWh/ ha)	477.42	1582.65	-1105.23

The perusal of Table 10 showed that in maize crop water productivity was higher in the case of large farm size categories (2.17) and low in the case of small farmers (1.92) whereas on the other side in the case of paddy crop, there was not much difference in water productivity across different farm size categories ranging from 0.64 to 0.68. Large farmers had more and easy access to means of irrigation, so water-use was more in the case of large farmers in both the crops i.e. in maize crop it was 2483.85 m^3/ha and in paddy crop, it was 10483.69 m^3/ha.

The perusal of Table 11 clearly revealed that maize crop was effective in saving of irrigation water to the tune of 7026.92 m^3 per ha as compared to paddy crop. It is due to the fact that in the case of paddy crop, total 22 irrigations on an average were applied by the sample farmers whereas in the case of maize crop only 5 irrigations were applied by the sample farmers including pre-sowing irrigation. The per hectare water productivity in maize crop was 2.09 kg per m^3 and in paddy, it was 0.67 kg per m^3, clearly showed that the productivity of maize crop was much more higher than the paddy crop. The energy-use per hectare was lower in the case of maize crop as compared to paddy crop. About, 1105.23 kWh of energy was saved in maize crop as compared to paddy crop.

Had the electricity being given free to Punjab farmers

Table 12. Decrease in net returns in the absence of power subsidy to agriculture sector among sample farmers, Punjab, 2014-15

(₹/ha)

Particulars	Maize	Paddy
Variable Cost	30822.25	46550.95
Gross returns	58809.95	84552.05
Returns over variable cost	27987.70	38001.10
Irrigation cost for pumping out groundwater	2177.04	7216.88
Actual variable cost	32999.29	53767.83
Actual returns over variable cost	25810.66	30784.22
Percentage of fall in returns	8.43	23.44

for irrigating the crop been charged by the Punjab government, the irrigation cost would have been ₹7216.88 for paddy crop and ₹2177.04 for maize crop; making variable cost of ₹53767.83 for paddy and ₹32999.29 for maize (Table 12). Then returns would have been decreased to 8.43 percent in the case maize crop and 23.44 percent in the case of paddy crop respectively from overall existing returns among the sample farmers.

CONCLUSIONS

Maize (*Zea mays*) is one of the most important cereal crop, globally what makes maize a popular crop from cultivation point of view is its versatility in terms of its suitability to diverse agro-climatic zones offering highest genetic yield potential amongst other cereal crops. The average overall operational holding with the sample farmers were 5.22 hectares in which only 1.31 hectares were under maize crop. The area under maize has shown continuous declining because the assured marketing for paddy, which ensures better returns from paddy cultivation under the present price policy, were the major reasons for this, whereas there was a continuous upward surge in the yield of maize may be due to development and adoption of improved and hybrid varieties in the state.

In the case of maize crop, the gross returns worked out to be ₹58809.95 whereas in paddy crop, gross returns were ₹84552.05. The per hectare variable cost incurred on maize crop and paddy crop were ₹30822.25 and ₹46550.95 respectively. The overall returns over variable cost in maize came out to be ₹27987.70 whereas in paddy it was ₹38001.10 in the case of paddy crop. The overall benefit-cost ratio of 1.91 in the case of maize and 1.82 in the case of paddy crop was realized. It was more in the case of maize crop as compared to paddy crop. The productivity of the maize cultivation was positively related to the seed and human labour-use, as the regression coefficients came to be positive and significant. On the other hand, the paddy cultivation was positively related to the plant protection, urea, DAP and water-use and negatively related to human labour for the overall sample.

Maize crop was effective in saving of irrigation water to the tune of 7026.92 m^3/ha as compared to paddy crop. The per hectare water productivity in maize crop was 2.09 kg per m^3 and in paddy, it was 0.67 kg per m^3, clearly showed that the productivity of maize crop was much more higher than the paddy crop. The per hectare energy-use was less in the case of maize crop as compared to paddy crop. About, 1105.23 kWh energy was saved in maize crop as compared to paddy crop.

REFERENCES

Economic Advisor. (2014). *Statistical abstract of Punjab.* Economic and Statistical Organization, Government of Punjab, Chandigarh.

Kaur, A., & Kaur, P. (2012). Shift in cropping pattern vis-à-vis stress on water resources in Punjab. *Indian Journal of Economics and Development, 8,* 91-98.

Kaur, B. (2011). Impact of climate change and cropping pattern on groundwater resources of Punjab. *Indian Journal of Agricultural Economics, 66,*373-387.

Kaur, B., Vatta, K., & Sidhu, R.S. (2015). Optimizing irrigation water use in Punjab agriculture: Role of crop diversification and technology. *Indian Journal of Agricultural Economics, 70,*307-318.

Saran, S.K, Kataria, P., & Kaur, A. (2013).An electricity energy usage and energy subsidy in Punjab agriculture. *Indian Journal of Economics and Development, 9,* 199-206.

Sidhu, R.S., Vatta, K. & Dhaliwal, H.S. (2010). Conservation agriculture in Punjab-Economic implications of technologies and practices. *Indian Journal of Agricultural Economics, 65,* 413-427.

Vashisht, A.K. (2014). Maize cultivation in Punjab: Bumper production, poor returns. *Economic and Political Weekly, 49,* 39-45.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 96-101
DOI: 10.5958/2322-0430.2018.00042.2

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Analysis of Inter-State Differentials in Performance of Agriculture in India

Amandeep Kaur[1] and P. Kataria[2]*

[1]*Assistant Professor, ACET, Amritsar, and* [2]*Professor of Economics, Department of Economics and Sociology Punjab Agricultural University, Ludhiana-141004*

[*]*Corresponding author's email: amandeepkaurrandhawa01@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-95* *Revision Accepted: March 08, 2018*

ABSTRACT

The present study has been conducted to bring forth inter-state differentials in the performance of Indian agriculture over the years and to explore the signs of convergence among the states. The study is based on the secondary data for 15 major agricultural states, for the time frame, 1980-81 to the latest available. Agricultural performance assessed on the basis of production profile of crops crucial for food security and Net State Domestic Product from agriculture and allied sector highlighted widespread inter-state differentials. The convergence analysis was carried out for the four time periods: 1980-81 to 1989-90, 1990-91to1999-00, 2000-01to 2012-13 and the overall study period with agricultural performance proxied by Net State Domestic Product from agriculture and allied activities. The analysis pertaining to the period 2000-01 to 2012-13 provided strong evidence of - convergence implying that the states have started giving the signs of convergence post-2000. The analysis has very well established that poor performing states have started catching up with the states, well known for their agricultural advancement, which would prove beneficial for the sustained food security and overall agricultural growth of India.

Keywords

-convergence, agriculture, differentials, NSDP.

JEL Codes

O11, O13, Q00, Q15, Q24.

INTRODUCTION

India, with a total land area of approximately 329 million hectares, accounting for a meager 2.4 percent of the world's surface area, sustains close to one-fifth of the world's human population, amounting to a little over 1.3 billion (2016) residing in 29 states and 7 union territories. Indian agriculture is known for its diversity and has considerable heterogeneity in terms of resource endowments, climatic conditions, infrastructural development and institutional arrangements, which do influence the crop mix, technology adoption levels, input usage pattern, crop productivity and price regime, which in their own right are likely to influence the pattern and sources of growth across regions (Birthal *et al.*, 2013; Challa *et al.*, 2004). Because of regional variations, the pattern of land use and thereby that of its agricultural growth and response to various stimuli and inducements vary greatly across states. Some states have achieved rapid economic growth over the years, whereas others have languished (Sachs, 2002). Regional disparities and instability in agriculture have been the subject matter of debate in the area of agricultural economics in India. During India's post-independence period, researchers and policymakers in India gave due attention to the pronounced economic disparities confronting the Indian states. This is evident from the steps taken to tackle the issue of regional disparities on priority in successive Five Year Plans after independence. Balanced growth of all regions of the country has been considered the prerequisite for economic stability and viability of the nation itself. Various policies and programs have been undertaken for fulfilling the goal of achievement of sufficiently high economic growth and all-round development of the country (Goli *et al*., 2014). It is against this backdrop, the present paper attempts to delve into the issue of inter-state differentials in the performance of agriculture and to explore as to how well the efforts to fulfill the goal of balanced regional development have translated into convergence among Indian states.

DATA AND METHODOLOGY

The present study has been narrowed down to India's major agricultural states. i.e. Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal. The 15 selected states account for 77 percent (2012-13) of the total land area of the country and support nearly 88 percent (Census, 2011) of the population. As regards the share of these 15 states in the total agricultural workforce of India, it comes out to be 88.3 percent.

Secondary data have been used to meet the stipulated objectives of the study. The time series data on the pertinent variables were collected from 1980-81 to 2012-13 from various issues of Agricultural Statistics at a Glance, Statistical Abstract of India, Agriculture Census Reports and web sources like www.indiastat.com. The data relating to the value of output from agriculture and allied activities were culled from the website of Central Statistical Organization.

RESULTS AND DISCUSSIONS

The results of the study have been presented under the following sections.

Contribution of different States to India's Agriculture

In this section, an effort has been made to bring forth the comparative contribution of different states in the national agricultural production. The comparative contribution of different states to India's agriculture for the period 2012-13 has been presented in Table 1. Total foodgrains accounted for 120.7 million hectares of the land area of the country leading to 257.1 million tons of production. During 2012-13, Uttar Pradesh accounted for the highest (19.7 percent) food grains production, followed by Punjab (11.1percent). Punjab accounted for 11 percent of the total food grains output from only five percent of the area under food grains. This was attributed to higher productivity of wheat for Punjab as compared to other states. On the contrary, Rajasthan, the largest state of India with 12.5 percent of country's net area sown and 10.3 percent of food grains area accounted for only 7.1percent to the national food grains production. The state of Gujarat with three percent of the food grains acreage contributed 2.7 percent to the national food grain output. On the other hand, the state of Madhya Pradesh with 11.7 percent of the country's food grains acreage accounted for 9.2 percent of the national production.

Rice is the main staple food of the country, which is cultivated in all the selected states. In the year 2012-13, rice accounted for 42.7 million hectare area of the country leading to production to the tune of 105.2 million ton. It was made possible by the impressive improvement in productivity in many of the states over the years. The study highlighted that the state of West Bengal with 12.7 percent of the country's rice acreage was the largest producer of rice (14.3 percent). West Bengal was followed by Uttar Pradesh (13.7 percent) and Punjab (10.8 percent). Punjab with 6.7 percent of the country's rice acreage made much more contribution as compared to Uttar Pradesh with 13.7 percent of the country's rice acreage, the reason being the high productivity of Punjab.

Wheat is the second most important crop after rice. Wheat grown on close to 30 million hectares of the total land area of the country accounted for 93.5 million tons of

Table 1. Contribution of selected states in India's agricultural production, 2012-13

Particulars	Net area sown	Gross cropped area	Foodgrains		Rice		Wheat	
			A	P	A	P	A	P
Unit	10^6 ha	10^6 ha	10^3 ha	10^3 mt	10^3 ha	10^3 mt	10^3 ha	10^3 mt
India	139.93	194.40	120770	257135	42754	105241	29995	93507
States			**Percent of India**					
Andhra Pradesh	7.9	7.0	3.4	4.1	5.2	6.5	0.0	0.0
Bihar	3.9	4.0	5.6	6.2	7.7	7.2	7.4	5.7
Gujarat	7.4	6.5	3.0	2.7	1.6	1.5	3.4	3.1
Haryana	2.5	3.3	3.6	6.3	2.8	3.8	8.3	11.9
Himachal Pradesh	0.4	0.5	0.7	0.6	0.2	0.1	1.2	0.7
Karnataka	7.0	6.0	6.0	4.2	3.0	3.2	0.8	0.2
Kerala	1.5	1.3	0.2	0.2	0.5	0.5	0.0	0.0
Madhya Pradesh	11.0	11.9	11.7	9.2	4.4	2.6	17.7	14.0
Maharashtra	12.4	11.3	8.8	4.3	3.6	2.9	2.6	1.3
Odisha	3.8	4.6	4.2	3.1	9.4	6.9	0.0	0.0
Punjab	3.0	4.0	5.4	11.1	6.7	10.8	11.7	17.7
Rajasthan	12.5	12.3	10.3	7.1	0.3	0.2	10.2	9.9
Tamil Nadu	3.2	2.6	2.2	2.2	3.5	3.8	0.0	0.0
Uttar Pradesh	11.8	13.3	16.5	19.7	13.7	13.7	32.5	32.4
West Bengal	3.7	5.0	5.0	6.4	12.7	14.3	1.1	1.0

production. The state-wise analysis highlighted that Uttar Pradesh was the largest producer of wheat with 32.4 percent of the national production from 32.5 percent of the country's wheat acreage. Uttar Pradesh was followed by Punjab with 17.7 percent of the national wheat production from 11.7 of the country's wheat area. Other major wheat producing states include Madhya Pradesh (14.0 percent of national production), Haryana (11.9 percent production). Andhra Pradesh, Kerala, and Tamil Nadu are such states where wheat acreage and production was negligible.

The Inter-state productivity differentials in India have been carried out for the study period and the results are presented in Table 2. Analysis has revealed that productivity of Rice and Wheat was recorded highest for the state of Punjab (Rice: 3998 kg/ha and Wheat: 4724 kg/ha) during the period 2012-13. The conspicuously low growth rates observed for Punjab (Rice: 0.96 percent and Wheat: 0.72 percent) for the period 2000-01 to 2012-13 indicated that the state has already touched the production frontier. Punjab was followed by Haryana (3272 kg/ha) and Andhra Pradesh (3173 kg/ha) in terms of rice productivity during the period 2012-13. On the other hand, rice productivity was recorded the lowest for the state of Madhya Pradesh (1474 kg/ha).Analysis of CAGR for rice productivity has revealed that the compound annual growth rates were observed to be the highest for the state of Rajasthan (5.68 percent) followed by Madhya Pradesh (5.46 percent), and Gujarat (5.31 percent). A remarkably high rice productivity growth rates reflected that these very states have started catching up with the other agricultural developed states as far as the performance of rice productivity was concerned.

Madhya Pradesh has also emerged as a fast-growing state in terms of rice and wheat production as it can be inferred from the very high compound annual growth rates of yield improvement of 5.46 percent and 3.36 percent respectively over the 13 years study period. The results were in line with the findings of Noronha (2016) which also brought forth that Madhya Pradesh has witnessed an agricultural boom, and is swiftly becoming India's rice bowl.

Punjab has been observed to be the forerunner in wheat productivity also during the period 2012-13. It was followed by Haryana (4452kg/ha) and Uttar Pradesh (3113 kg/ha). CAGR for wheat productivity was recorded the highest for the state of Andhra Pradesh (6.19 percent) followed by Madhya Pradesh (3.36 percent), Karnataka (2.76 percent) and Gujarat (2.45 percent) over the recent past in the 12 year period (2000-01 to 2012-13) reflecting that these states have started catching up the states known for their agricultural advancement.

Factors Facilitating Agriculture: Inter-state Differentials

This section deals with the rank ordering of the states with respect to the factors facilitating agriculture. The overall performance of agriculture sector in India largely depends on what happens at the state level in terms of cropping pattern, input usage pattern, irrigation potential and above all farming policies. Table 3 highlights the rank ordering of states with respect to factors facilitating agriculture. There are wide variations in the performance

Table 2. Inter-state productivity differentials in India

Rice				Wheat			
Productivity 2012-13		Productivity growth 2000-01 to 2012-13		Productivity 2012-13		Productivity growth 2000-01 to 2012-13	
States	kg/ha	States	CAGR, percent	States	kg/ha	States	CAGR percent
Punjab	3998	Rajasthan	5.68	Punjab	4724	Andhra Pradesh	6.19
Haryana	3272	Madhya Pradesh	5.46	Haryana	4452	Madhya Pradesh	3.36
Andhra Pradesh	3173	Gujarat	5.31	Uttar Pradesh	3113	Karnataka	2.76
West Bengal	2760	Odisha	3.49	Rajasthan	3028	Gujarat	2.45
Tamil Nadu	2712	Bihar	2.27	Gujarat	2875	Maharashtra	2.39
Karnataka	2632	Maharashtra	2.14	West Bengal	2786	West Bengal	2.06
Kerala	2576	Kerala	1.96	Madhya Pradesh	2478	Himachal Pradesh	1.97
Uttar Pradesh	2460	Uttar Pradesh	1.49	Bihar	2427	Rajasthan	1.60
Bihar	2283	Haryana	1.37	Odisha	1894	Odisha	1.57
Gujarat	2198	Himachal Pradesh	1.22	Himachal Pradesh	1671	Uttar Pradesh	1.45
Maharashtra	1963	Karnataka	0.99	Maharashtra	1528	Haryana	1.41
Odisha	1814	West Bengal	0.99	Andhra Pradesh	1250	Bihar	1.31
Rajasthan	1771	Punjab	0.96	Karnataka	796	Punjab	0.72
Himachal Pradesh	1629	Andhra Pradesh	0.82	Kerala	-	Kerala	-
Madhya Pradesh	1474	Tamil Nadu	0.76	Tamil Nadu	-	Tamil Nadu	-

of different states in terms of various development parameters as is enunciated by very high values of coefficient of variation. The state of Punjab has grabbed the topmost position in terms of cropping intensity (189.6 percent) as well as fertilizer consumption during the period 2012-13. On the contrary, the state of Tamil Nadu (113.1 percent) was observed to be the least cropping intensive state for the same period. The per hectare fertilizer consumption ranged from as low as 96.3 kg/ha for Himachal Pradesh to as high as 502.7 kg/ha for Punjab during the period 2012-13. Punjab was followed by Haryana (482.6 kg/ha) and Andhra Pradesh (419.1 kg/ha). On the contrary, fertilizer consumption was recorded to be lowest in the state of Himachal Pradesh out of the studied states in 2012-13. The state of Uttar Pradesh accounted for the maximum Gross irrigated area (20.2 million ha) followed by Rajasthan (9.5 million ha) and Madhya Pradesh (9.0 million ha). On the other hand, Himachal Pradesh again accounted for the lowest gross irrigated area (195 thousand ha). The average size of land holdings ranged from as low as 0.22 ha for Kerala to as high as 3.77 ha for Punjab during 2010-11.

Economic Contribution of Agriculture Sector: Growth Differentials

This section pertains to the comparative performance of agriculture based on Net State Domestic Product from agriculture and allied sector ($NSDP_A$). The growth differentials in NSDP from Agriculture and Allied Sector in Indian states per hectare of net area sown for four time periods have been presented in Table 4. Figures pertaining to NSDP (net area sown basis) revealed wide-spread differentials in growth rates observed for the selected states. The compound annual growth rate for $NSDP_A$ on net area sown basis has been recorded as the highest for the state of Tamil Nadu (16.7 percent)for the period 1980/81-1989/90, followed by West Bengal (16.4 percent) and Odisha (15.5 percent). Punjab recorded a growth rate of 12.5 percent over the same period. For the overall study period, the highest growth rate was recorded by West Bengal (14.4 percent) followed by Andhra Pradesh (12.9 percent) and Punjab (12.7 percent).

Convergence Analysis

The present study has focused on real convergence. An effort has been made to study the evidence of β –convergence in case of Indian states, the details of which are given below.

B-Convergence

It has been seen that poorer economies tend to grow faster than wealthier ones. Conditional beta convergence becomes relevant when regional economies are not structurally similar and welfare or output measures do not converge to the same level but the differences across regions become stationary and growth rates are the same in the long run. Aggregate convergence, in contrast, is consistent with a neoclassical framework whereby each region, while having a different initial position, converge to a common per-capita rate determined by exogenous technical progress. The neo-classical theory suggests that at low levels of per capita output, an economy grows at a high rate and vice versa. If two economies, similar in terms of parametric specifications, differ only with respect to their per capita output levels at some initial point of time, then at any subsequent point of time, the economy that started off with a higher per capita output should grow at a slower rate. This leads to the hypothesis of absolute or β-convergence, which predicts a negative

Table 3. Rank ordering of states with respect to factors facilitating agricultural growth

Cropping intensity 2012-13		Fertilizer consumption 2012-13		Gross irrigated area 2012-13		Average size of operational holding 2010-11	
States	**Percen**	**States**	**kg/ha**	**States**	**10^3ha**	**States**	**Ha**
Punjab	189.6	Punjab	502.7	Uttar Pradesh	20191	Punjab	3.77
West Bengal	185.9	Haryana	482.6	Rajasthan	9455	Rajasthan	3.07
Haryana	181.5	Andhra Pradesh	419.1	Madhya Pradesh	8966	Haryana	2.25
Himachal	174.4	Bihar	414.8	Punjab	7744	Gujarat	2.03
Odisha	167.0	Tamil Nadu	346.4	Andhra Pradesh	6268	Madhya Pradesh	1.78
Uttar Pradesh	155.9	Uttar Pradesh	342.3	West Bengal	6105	Karnataka	1.55
Madhya Pradesh	150.7	West Bengal	330.8	Gujarat	5913	Maharashtra	1.44
Andhra Pradesh	138.9	Karnataka	297.9	Haryana	5672	Andhra Pradesh	1.08
Rajasthan	137.0	Maharashtra	243.0	Bihar	5327	Odisha	1.04
Kerala	126.6	Gujarat	224.3	Maharashtra	4041	Himachal Pradesh	0.99
Maharashtra	126.1	Madhya Pradesh	191.0	Karnataka	4007	Tamil Nadu	0.80
Bihar	122.8	Rajasthan	121.9	Tamil Nadu	2991	West Bengal	0.77
Gujarat	122.3	Odisha	118.3	Odisha	1496	Uttar Pradesh	0.76
Karnataka	120.0	Kerala	108.2	Kerala	458	Bihar	0.39
Tamil Nadu	113.1	Himachal	96.3	Himachal	195	Kerala	0.22
C.V.	**17.9**	**C.V.**	**48.7**	**C.V.**	**81.6**	**C.V.**	**67.4**

relationship between the rates of growth enjoyed by a cross-section of economies and the levels of their per capita outputs at a given initial point of time. In the figure that follows, each state is designated by a coordinate point representing growth of NSDP from Agriculture and Allied ($NSDP_{A)}$ over the study period and log of that particular states initial (here 1980-81) $NSDP_A$ per hectare of net area sown.

The next step in this paper is to test for β-convergence amongst Indian states analytically. The test for absolute β-convergence has been undertaken by following the methodology of Barro & Salaa-i-Martin (1992). The following equation has been estimated for this purpose.

$$[In(yi,t) \quad In(yi,t \quad T)]/T \qquad .In(yit \quad T) \quad {}_t$$

Where,

$[In(y_{i,t}) \quad In(y_{i,t \quad T})]/T$ is the ith state's annual average growth rate of NSDP from Agriculture and Allied Activities per hectare of net area sown between the period *t* and *t–T*, $Y_{i,t}$ and $Y_{i,t-T}$ are the NSDP from agriculture and allied activities per hectare of net area sown figures for the ith state at time *t* and *t–T* , respectively, and T is the length of the time period.

If the coefficient corresponding to the initial level of the selected variable bears a statistically significant negative sign, that is, if β<0, then we say that there exists absolute β-convergence. Rejecting the null hypothesis of β=0against the alternative of β<0 implies a negative correlation between the initial level of a variable and its subsequent growth. This signifies that relatively poor performing states improve the most and thus catch up with the better ones. The convergence equation was estimated by the Ordinary Least Squares (OLS) method using the $NSDP_A$ per hectare of net area sown data for 15 selected states.

The coefficient on the log of initial $NSDP_A$ per hectare of net area sown has the interpretation of a conditional rate of convergence. If the other explanatory variables are held constant, then the economy tends to approach its long-run position at the rate indicated by the magnitude of the coefficient. Results of regression analysis to test for β-Convergence have been presented in Table 5.

The coefficient on the initial level of $NSDP_A$ per hectare of net area sown secured a negative sign during the period 2000-01 to 2012-13, indicating thereby a tendency of convergence in $NSDP_A$ per hectare of net area

Table 4. Growth differentials in NSDP per hectare of net area sown from agriculture and allied in Indian states

States	Compound Annual Growth Rate (Percent)			
	1980/81-89/90	1990/91-99/00	2000/01-12/13	1980/81-2012/13
Andhra Pradesh	11.9	14.8	12.7	12.9
Bihar	13.5	5.5	13.3	10.3
Gujarat	9.3	12.7	17.1	11.5
Haryana	10.9	10.5	14.9	12.1
Himachal Pradesh	8.2	14.2	10.7	12.3
Karnataka	10.2	14.3	10.9	11.0
Kerala	14.8	12.4	12.4	9.6
Madhya Pradesh	9.4	13.3	13.3	10.2
Maharashtra	12.8	13.3	13.3	12.2
Odisha	15.5	13.2	13.2	9.0
Punjab	12.5	11.4	11.4	12.7
Rajasthan	12.8	15.9	15.8	11.9
Tamil Nadu	16.7	14.9	14.9	11.6
Uttar Pradesh	11.1	10.3	10.3	10.0
West Bengal	16.4	11.1	11.1	14.4

Table 5. Results of the regression analysis to test for β-Convergence

Dependent variable	Period	Constant	Coefficient	R^2
Growth in NSDP from Agriculture and Allied Activities/ ha of NSA	1980/81-1989/90	0.178^{***}	-0.008^{NS}	0.055
	1990/91-1999/00	-0.115^{NS}	0.0244^{NS}	0.205
	2000/01-2012/13	0.391^{***}	-0.0265^{***}	0.439
	1980/81-2012/13	0.156^{***}	-0.0053^{NS}	0.082

****** Significant at one percent level.***
NS: Non-significant.

sown across the states. The regression analysis was carried out for the entire study period (1980-81 to 2012-13) displayed significant convergence across the selected states for the period post-2000. The estimated statistically significant coefficient of -0.0265 ($\beta<0$ implies there exists absolute β-convergence) provided a strong evidence of convergence amongst the selected states post 2000 period. On the whole, analysis of agricultural performance proxied by Net State Domestic Product from agriculture and allied activities per hectare of net area sown provided strong evidence of -Convergence as indicated by highly significant, estimated coefficient of -0.0265 implying that the states have started giving the signs of convergence post 2000 at the rate 2.7 percent per year. It highlights that poor performing states were catching up the better performing states.

CONCLUSIONS AND POLICY IMPLICATIONS

The present study has been conducted to bring forth inter-state differentials in the performance of Indian agriculture over the years and to explore the signs of convergence among the states. The agricultural performance assessed on the basis of production profile of crops crucial for food security and net state domestic product from agriculture and allied sector highlighted widespread inter-state differentials. The convergence analysis pertaining to the period 2000-01 to 2012-13 provided strong evidence of - convergence implying that the states have started giving the signs of convergence post-2000. The analysis has very well established that poor performing states have started catching up with the states, well known for their agricultural advancement, which would prove beneficial for the sustained food security and overall agricultural growth of India.

REFERENCES

Barro, R.J., & Sala-i-Martin, X. (1992). Convergence. *Journal of Political Economy 100*, 223-51.

Birthal, P.S., Joshi, P.K., Negi, D.S., & Agarwal, S. (2013). *Changing sources of growth in Indian agriculture: Implications for regional priorities for Accelerating Agricultural Growth.* International Food Policy Research Institute Discussion Paper. New Delhi, India.

Challa, O., Ramamurthy, V., & Venugopalan, M.V. (2004). Dynamics of land use in relation to the green revolution in India. Land use, land cover, and soil sciences. *Encyclopedia of Life Support Systems, 4.* Retrieved from www.eolss.net.sample-chapters/c19/E1-05-05-04.pdf

Goli, S., Perianayagam, A., & Bhemeshawar, R. (2014). *Socio-Economic progress across the major Indian states: Converging or diverging*. Munich Personal RePEc Archive Paper 59667. Retrieved fromhttps://mpra.ub.unimuenchen.de/59667/4/MPRA_paper_48978.pdf

Noronha, R. (2016) High on rice paddy. *India Today 41,* 52-56.

Sachs, J.D., Bajpai, N., & Ramiah, A. (2002). Understanding regional economic growth in India. *Asian Economic Paper I.* The Earth Institute, Columbia University and the Massachusetts Institute of Technology, New York, USA.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 102-105
DOI: 10.5958/2322-0430.2018.00043.4

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Basmati Cultivation for Sustainable Agriculture in Punjab

Ajaypal Singh and D.K. Grover*

Department of Economics and Sociology, Punjab Agricultural University, Ludhiana- 141 004

**Corresponding author's email: ajaypalgill90@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-96* *Revision Accepted: March 05, 2018*

ABSTRACT

The present study examines the impact assessment of Basmati rice in terms of input use, cost-effectiveness, and addressing the sustainability issues at the farm level in Sri Muktsar Sahib district of Punjab using primary data. From the study area, a sample of 120 farmers randomly selected from two blocks and from each block, 30 basmati, and 30 non-basmati adopters were selected. Input use pattern revealed saving of 3.07 per cent in human labour in basmati as compare to non-basmati. The machine labour saving in basmati was 1.82 per cent against non-basmati. The results brought out that saving in number of irrigations for basmati was 16.50 per cent. The per hectare total variable cost in basmati (₹26051) was lower when compared with non-basmati (₹27268) and the return over variable cost in basmati was 3.69 per cent more than non-basmati. The returns per rupee spend on basmati was ₹4.26 against ₹4.00 in non-basmati. The study suggested that for faster adoption of basmati, both State, as well as Central Governments, should frame a policy to save farmers from price fluctuations through ensuring some minimum income support to its cultivators and improvement in the knowledge of farmers regarding new techniques and technologies. Even though the research and extension linkages in Punjab are fairly strong, the qualitative improvement by reaching low productivity farmers through the involvement of crop scientists and extension personnel is very much needed.

Keywords
Basmati rice, economics of cultivation, input use, non-basmati rice.

JEL Codes
O13, Q13, Q15, Q25, Q28.

INTRODUCTION

Punjab is one of the most fertile regions on earth. It is called Bread-Basket of India. The state of Punjab contributed 43 per cent of wheat and 23 per cent of rice to the central pool of the country (Indiastat, 2016).The early success of the Green Revolution in Punjab prompted the Government of India to target the state as a source for rice and wheat for the national food procurement and distribution system, at a guaranteed price. Subsequently, the state government of Punjab provided electricity for agricultural pumping at a flat rate, irrespective of the quantity of groundwater used. These two factors led to the establishment of a rice-wheat annual crop rotation (Sharma *et al*., 2012).

Rice-wheat system demands a large amount of water which has been met by exploiting groundwater resources. Intensive cultivation of rice and wheat is being practiced in Punjab with over and injudicious use of natural resources as well as applied inputs in the state. The quantity and quality of underground water in the state are declining. Groundwater irrigation, which is a bigger source of irrigation today with a significant gain in its coverage area in the past four decades due to increasing in a number of tubewells. Tubewells are the main source of irrigation in the state followed by canals. In the state, almost 99 per cent of the net sown area is irrigated, 72 per cent of which is contributed by tubewells and the remaining 28 per cent by canals. The net area irrigated by tube wells has gone up in the last two decades. (Economic Advisor, 2016).

Groundwater table in Punjab is depleting day by day due rice-wheat crop rotation. to check the groundwater table depletion there is need to find the suitable alternatives of rice crop but replacement of rice crop is very difficult due to assured market. So, Basmati rice can act as an alternative of the non-basmati rice crop. In basmati, irrigation requirement is low as compare to non-basmati because basmati crop is short duration crop and

sown late as compare to the non-basmati and the basmati crop is sown at the time of monsoon arrival. Due to high export value, farmers get a higher profit from basmati.

Basmati is long grain aromatic rice grown for many centuries in the specific geographical area at the Himalayan foothills of Indian sub-continent. India being the world's largest producer, contributes more than 70 per cent of the total world basmati rice production and the rest is produced by Pakistan mainly from Punjab and Sindh states. Basmati rice is a good source of export among the agricultural commodities. Export of basmati rice from India has increased from about 8.51 lakh tonnes during 2000-01 to 37.57 lakh tonnes during the year 2013-14 (Grover *et al*., 2014)

The aim of this study is to Increase area under basmati by replacing non-basmati paddy to minimize water use, reduce the use of agro-chemicals and thus cost of cultivation, improve crop yield & quality of the basmati grain and provide related information to the farmers regarding basmati cultivation.

MATERIAL AND METHODS

The study was purposively conducted in Sri Muktsar Sahib district of Punjab- a region with rice-wheat system dominance, two blocks namely Gidderbaha and Malout were selected at the first stage. From each block, two villages were selected at the second stage. From block Gidderbaha, Kauni and Gurisanghar villages were selected, from Malout, villages selected were Rupana and Mehraj wala. The farmers were selected using simple random sampling technique, a sample of 60 farmers (30 basmati + 30 non-basmati) was selected from each block. The study was based on the total sample of 120 farmers spreading over different farm size groups. A well-designed, comprehensive and pre-tested schedule was used to collect the primary data from farmers through personal interview method. Data pertaining to the practices, i.e. basmati and non-basmati sowing was collected for the data pertaining to the agricultural year 2014-15. The data on general information about the respondents, family size, age, education, occupation, sources of income, operational holding, cropping pattern and other details were obtained from them. Further, data on various input used in rice cultivation like chemical fertilizers, plant protection chemicals, seed rate and variety, human and machinery labour and cultivation practices such as land preparation, irrigation, harvesting, threshing, transportation along with labour required for these operations were collected from the sample farmers.

The costs, returns and profits in 'Basmati' and 'Non-basmati' production computed on per hectare basis were compared. The cost of human labour was estimated in terms of standard man days. Further, imputed value of family labour was calculated at the prevailing wage rate. For machine-related farm operations, their rental value was used for calculating the total variable cost. The cost of seeds, fertilizers, and chemicals (weedicide, pesticide, and insecticide) and diesel were calculated based on the actual expenditure incurred. The interest on working capital was computed at nine per cent banking lending rates for the half period of the crop season. Since electricity and water charge are not charged from farmers of Punjab, hence, electricity cost was not included in the cost of production.

Gross return was calculated by multiply the price of the main product (per q) into yield (q) per hectare. Total variable cost included the cost of fertilizers, land preparation, seed cost, sowing/ transplanting cost, labour cost, plant protection cost, etc. but in total variable cost, irrigation cost was not included. The return over variable cost was deliberated as the difference between gross returns and total variable cost.

RESULTS AND DISCUSSION

Labour-use Pattern

Human labour is a vital input to perform various on-farm and off-farm activities. An attempt has been made to examine the human labour employment pattern in the cultivation of rice crop under basmati and non-basmati. The total human labour hours used for acting different operations in rice cultivation like ploughing of field, sowing of seed, manuring, spraying insecticides etc. under basmati and non-basmati have been presented in Table 1. In basmati, the total human labour-used was 161.13 hours per hectare respectively, and in non-basmati was 166.08 hours per hectare.

Whereas, in basmati, the human labour in land preparation process was found to be 12.65 hours per hectare and 12.90 hours per hectare in non-basmati. The transplanting labour was more in basmati (37.98 hours per hectare) as compare to non-basmati (33.89 hours per hectare).the 9.98 per cent labour save in process of irrigation in basmati as compare to non-basmati.

In the application of manures and fertilizers the 11.75 per cent save of labour in basmati as compare to non-basmati. If we looked at consumption of human labour for harvesting, transportation, and marketing, there were 6.23 and 16.23 per cent save in basmati as compare to non-basmati.

Table 1. Labour use pattern of Basmati and Non-basmati crop of the sample of the farmers in Sri Muktsar Sahib, Punjab, 2014-15

(Hr/ha)

Particulars	Basmati	Non-basmati	Percent change
Land preparation	12.65	12.90	1.96
Transplanting	37.98	33.89	-10.75
Irrigation	45.77	50.34	9.98
Manures & Fertilizers	15.34	17.14	11.75
Weeding/ Hoeing	23.15	23.88	3.18
Plant Protection	17.18	16.29	-5.17
Harvesting	5.82	6.18	6.23
Transportation & Marketing	4.70	5.46	16.23
Total	161.13	166.08	3.07

Machine-use Pattern

The machine-use pattern of Basmati and Non-basmati crop of the sample of the farmer presented in Table 2. The machine use was slightly low in basmati as compare to non-basmati. The total machine use was 10.23 hours per hectare in basmati and 10.42 hours per hectare in non-basmati. The machine used in land preparation was 7.28 hours per hectare in basmati and 7.27 hours per hectare in non-basmati. The machine used in harvesting and transportation and marketing was 1.46 and 1.49 hours per hectare in basmati and 1.51 and 1.64 hours per hectare in non-basmati respectively.

Table 2. Machine-use pattern of Basmati and Non-basmati crop of the sample of the farmers in Sri Muktsar Sahib, Punjab, 2014-15

(Hr/ha)

Particulars	Basmati	Non-basmati	Percent change
Land preparation	7.28	7.27	-0.2
Harvesting	1.46	1.51	3.6
Transportation and Marketing	1.49	1.64	10.6
Total	10.23	10.42	1.82

Major Farm Inputs use Pattern

The pattern of inputs used in basmati and non-basmati cultivation for sample farmers is presented in Table 3. The results showed that basmati farmers applied 22.75 number of irrigation against 27.27 number of irrigation in Non-basmati. The human labour used in basmati was 161.13 hours per ha and 166.08 hours per ha in Non-basmati fields. The human labour 3.07 per cent save in basmati as compare to non-basmati. Machine hours used in basmati was 10.23 hours ha^{-1} and in non-basmati was 10.42 hours ha-1. In fertilizers, 22.63 per cent urea saves in basmati as compare to non-basmati.

Table 3. Major farm inputs used in Basmati and Non-basmati crop of the sample of the farmers in Sri Muktsar Punjab, 2014-15

(Per ha)

Particulars	Basmati	Non-basmati	Percent change
No of irrigations	22.75	27.27	16.5
Hours/irrigation	1.73	2.01	16.38
Seed rate (kg)	15.55	14.93	-3.97
Human labour	161.13	166.08	3.07
Machinery labour	10.23	10.42	1.82
Urea (kg)	224.07	274.78	22.63
DAP (kg)	67.99	70.37	3.50
Sulphur (kg)	10.63	10.77	1.34
Zinc (kg)	14.88	12.99	-12.70

Urea used in basmati was 224.07kg per ha and 274.78 kg per ha in non-basmati. DAP, Sulphur, and Zinc were 67.99, 10.63 and 14.88 kg used in basmati and 70.37, 10.77 and 12.99 kg used in non-basmati respectively.

Cost of Cultivation

The various inputs used in physical as well as value terms per hectare of basmati and non-basmati crop farms have been discussed in Table 4. Per hectare cost of human labour showed a decline in the case of basmati, which was mainly due to saving in irrigation and fertilizers labour cost. The human labour cost in basmati was ₹6301 per ha and ₹6555 per ha in non-basmati.If we looked at the average machinery cost per hectare, there was a rise in the cost with basmati. Machinery was ₹2684 ha^{-1}in basmati and ₹2904ha^{-1}in non-basmati. With regard to seed used in rice production, the study revealed that seed expenditure was less under the non-basmati cultivation as compared to basmati. The expenditure spends on seed was ₹838 per hectare in case of basmati as compared to `793 per hectare in case of non-basmati. The expenditure on plant

Table 4. Cost of rice cultivation under DSR and Non -DSR technology of the sample of the farmers in Sri Muktsar Sahib, 2014-15

Particulars	Basmati		Non-Basmati	
	Physical term	Value term (₹ha^{-1})	Physical term	Value term (₹ha^{-1})
Human labour (hr ha^{-1})	143.4525	6301	164.25	6555
Machine labour (hr ha^{-1})	10.32	2684	10.99	2904
Seed (kg ha^{-1})	15.54	838	16.92	793
No of Irrigation	22.75	1338	27.27	1715
Urea (kg ha^{-1})	224.06	1210	274.77	1484
DAP (kg ha^{-1})	67.98	1496	70.36	1548
Sulphur (kg ha^{-1})	10.62	638	10.76	646
Zinc (kg ha^{-1})	14.88	893	12.99	781
Plant protection		4748		4617
Harvesting		3143		3083
Transportation and Marketing		887		1065
Interest on variable cost		988		1010
Total variable cost		26051		27268

protection chemicals (weedicides and insecticides) for rice cultivation was observed more on basmati farms (₹4748 per hectare) than non-basmati farms (₹4617 per hectare). The results showed more quantity of urea was used on non-basmati (274.77 kg per ha) with the expenditure of ₹1484 per hectare than basmati farms (24.06 kg per ha)with the expenditure of ₹1210 per hectare. The DAP usage per hectare was found more i.e. 70.36 kg per ha in case of non-basmati as against 67.98 kg ha-1 in case of basmati valued at ₹1548 per haand ₹1496per ha respectively. The transportation and marketing cost increase in non-basmati was ₹1065 per ha and in basmati was `887 ha^{-1} increased in these costs was mainly due to increased yield in non-basmati. The cost of cultivation in basmati (₹26051per ha) was lower when compared with that in non-basmati (₹27268 ha^{-1}).

Economics of Basmati and Non-basmati Cultivation

The profitability of basmati and non-basmati production in the study area has been analyzed by computing per hectare cost and returns (Table.5). The variable cost was slightly less in the case of basmati i.e. ₹26051per ha than compared to non-basmati (₹27268 per ha). The results further pointed out that basmati yield was low. The yield realized in basmati was 45.70 q per ha while it was 75.26q per ha with non-basmati. The gross return in basmati was ₹111051 per ha and ₹109127 per ha in non-basmati. The return over variable cost realized was higher in basmati (₹85000per ha) as compared to non-basmati (₹81859per ha) mainly due to higher returns. The returns per rupee spend in basmati was ₹4.26 against ₹4.00 in non-basmati.

Table 5. Economics of rice cultivation under DSR and Non- DSR technology of the sample of the farmers in Sri Muktsar Sahib, Punjab, 2014-15

Particulars	Basmati	Non-basmati	Percent change
Cost of cultivation (₹ha^{-1})	26051	27268	5
Grain yield (q ha^{-1})	45.70	75.26	39
Grain price (₹/q)	2430	1450	-40
Gross return	111051	109127	-1.73
ROVC (GR-TVC) (` ha^{-1})	85000	81859	3.69
Variable cost of production (₹/q)	570	362	-36.49
ROVC (₹/q)	1860	1088	-41.50
B-C Ratio (GR/TC)	4.26	4.00	6.10

GR: Gross return; ROVC: Return over variable cost; TVC: Total variable cost; B-C ratio: Benefit-cost ratio; TC: Total cost.

CONCLUSIONS

Basmati rice entailed substantial time savings for the farmers because it could be late sown as compare to non-basmati. Due to the late sowing of basmati the less number of irrigations required as compare to non-basmati, about 25 per cent fewer irrigations required in basmati. With the adoption of basmati the cost of labour, machine use, irrigation was reduced. The incremental increase in returns over variable cost in basmati was 3.69 per cent more as compare to non-basmati. To make the adoption of basmati faster there is a need to identify the constraints and solutions thereof. As basmati cultivation is important from the ecological as well as farm incomes point of view; both State, as well as Central Governments, should frame a policy to save farmers from price fluctuations through ensuring some minimum income support to its cultivators. As a significant proportion of farmers still depend upon the traders for basmati price information, there is need of providing wider coverage to collecting and dissemination of agricultural market intelligence/information so that prices prevailing in each and every market is available to them for making adequate marketing decisions. The study revealed that basmati paddy prices remained generally low during harvesting/peak period and high during the lean period. However, farmers had disposed of more than eighty per cent of marketed surplus immediately after harvesting at relatively low prices. Especially, small and marginal farmers lack facility or money to sell where they want or keep their produce and sell when the price is suitable/high. Proper organizations, both collective and government organizations may tackle these issues in order to ensure the good price of farmer's output. There is need to encourage the farmers to opt for farm level storage through the creation of efficient storage structures at the farm level. The production-related problems can be handled through improvement in the knowledge of farmers regarding new techniques and technologies. Even though the research and extension linkages in Punjab are fairly strong, the qualitative improvement by reaching low productivity farmers through the involvement of crop scientists and extension personnel is very much needed. To be the credible supplier of basmati rice in the world market, the country should formulate a long run export policy. Although short-run benefits to basmati rice milling industry/exporters provided by State Government had helped the industry in competing in the world market, urgent steps should be taken to frame the long run policy in this regard.

REFERENCES

Economic Advisor. (2016). *Statistical abstract of Punjab*. Economic and Statistical Organization, Government of Punjab, Chandigarh.

Grover, D. K., Singh, J., Kumar, S., & Singh, J. M. (2014). *Relationship between wholesale prices, retail prices, export prices (fob), prices realized by farmers and details of contributing factors for the price difference for basmati rice in Punjab* (p. 2-3). Agro Economic Research Centre, Punjab Agricultural University, Ludhiana.

Indiastat. (2016). Area and production of rice in India and Punjab. Retrieved from http//www.indiastat.com on 15-05-17.

Sharma, P., Krishnamurthy, C.K.., Sidhu, R.S., Vatta, K., Kaur, B., Modi, V., ... Lall, U. (2012). Columbia water center white paper. *Restoring groundwater in Punjab, India's bread basket: Finding agricultural solution for water sustainability.* Retrieved from http://water.columbia.edu retrieved on 19-12-2013.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 106-112
DOI: 10.5958/2322-0430.2018.00044.6

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Review of Contract Farming Regulations with special reference to State of Maharashtra and Gujarat

Varun Miglani[1] and S. S. Kalamkar[2]*

Symbiosis School of Economics (Department of Symbiosis International University), Pune-411004
Agro-Economic Research Centre, Sardar Patel University, Vallabh Vidyanagar, Gujarat

[*]Corresponding author's email: varunmiglani@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-100* *Revision Accepted: March 10, 2018*

ABSTRACT

There is a consensus among experts and policymakers that contract farming (CF) helps to render small-scale farming competitive with large-scale farming as it enables the farmers to access technology, credit,andmarketingchannels, with low transaction costs. However, studies made in the early 2000s found that in the absence of laws governing in appropriate ways the contracts between firms and farmers, the contracts tended to be very unfair to the farmers. Agricultural marketing is, in India, governed by the various states; so, the Union Ministry of Agriculture in 2003 circulated to the 28 states and 7 unionterritory governments a model "Agricultural Produce Marketing (Development & Regulation) (APMR) Act" and, in 2007, a set of model rules for implementing such an act. This model APMR act and set of rules include provisions for the registration of contract farming sponsors, the recording of CF agreements with some authority prescribed under the act, and a vital dispute-settlement mechanism. The rules are intended to protect the interests of farmers. As of 2015, 21 states have made legal provisions accordingly, but in reality, many of the contracting firms are not registering with the prescribed authorities. The multi-national corporations drawing up the CF contracts in regard to the large-scale production of white onions and chip-grade potatoes in Maharashtra and Gujarat have not registered themselves with the prescribed district authorities in. Survey conducted in 2012-13 in selected districts of Maharashtra found that the farmers, unaware of the existence of dispute-settling authorities, felt helpless whenever a dispute would arise. In this paper, attempt is made to review the CF rules in the national Model APMR Act; and identify, in the light of that review and of discussions with selected contracting firms and Government officials, some suggestions on how to make contract farming rules more participatory and effective have been suggested. We argue that better compliance of the CF rules would reduce the amount of troublesome uncertainties in regard to exploitation by contracting firms, and would thereby strengthen the CF system.

Keywords
Compliance, contract farming, firm, regulations.

JEL Codes
L11, L23, L24, Q13, Q18.

INTRODUCTION

Contract Farming (CF) is one of the institutional mechanisms of linking the different parties in agro-food chain (Gulati *et al.,* 2008). CF can be defined as "an agreement, oral or written, between farmer or farmer groups and processing and/or marketing firms, commercial or otherwise, for the production and supply of agricultural products under pre-specified conditions, frequently at predetermined prices. The arrangement could also involve the purchaser providing a degree of production support through, for example, the supply of inputs and the provision of technical advice. The basis of such arrangements is thus a commitment on the part of the farmer to provide a specific commodity in quantities and at quality standards determined by the purchaser and a commitment on the part of the company to support the farmer's production and to purchase the commodity" (Narayanan, 2011). The firm needs adequate raw material or commodity of particular size, grade, colour, etc. and also at right cost for maintaining its competitive advantage. As the raw material/commodity is not available in open market; the firm has to go to the farmers and create adequate incentives for them to grow that crop. Hence, it is observed that CF is prevalent in crops which

do not have strong volume sales in APMC markets. It is being observed that CF is practiced across various commodities like chip-grade potato, white onion, seeds, sugarcane, cotton, poultry, palm fruit, etc.

CF as system of growing certain crops has been prevalent in India since second half of the nineteenth century. It all started when the Britishers through East India Company introduced the cultivation of indigo, poppy and the plantation crops of tea, coffee, rubber, tobacco, etc. (Dev & Rao, 2005; Deshpande, 2005). However, after economic liberalization measures in after late 1980's, contract farming became the buzz word as MNCs like PepsiCo, ITC and few others started their ventures in agribusiness in India. There is growing evidence that contract farming arrangements (CFAs) are expanding across the country (Ghosh, 2013; National Commission on Farmers, 2006b). Readers can refer to Asokan & Singh (2003) for understanding the concept of CF and its benefits. However, many papers viz. Singh (2002), Sivramkrishna & Jyotishi (2008)[1]; Bijman (2008, p. 13) have term this relationship between farmer and firm as unequal, as on one hand we have a firm and on the other hand there are farmers who may not be knowledgeable and have to accept the terms and conditions laid out by firm. Clapp (1994) in his case study of a banana-producing cooperative in Honduras reveals CF as the means of exploiting peasantry.

The Government of India's policy documents[2] emphasizes the need to encourage CF as it would boost crop diversification by providing assured and remunerative market opportunities for farmers. CF is also viewed as a useful instrument for linking farmers to corporate buyers who can provide information and also inputs and extension tailored to the specific crops (Planning Commission, 2008). As pointed out in the Fourth Report of the National Commission on Farmers (2006a), that 50 percent of the small farmers' produce is sold in distress and points out towards several policy level changes, increased investments and creation of more effective instruments, systems and structures to remedy the situation, including mitigation of market risks. As Glover & Kusterer (1990) point out that contract farming be considered an effective institutional response to overcome such market imperfections.

In lieu of improving the efficiency of marketing system and encourage privates sector investments in agriculture, Government of India finalised a model "*Agricultural Produce Marketing (Development and Regulation) Act*" in 2003 and, in 2007, a set of model rules for implementing such an act, which were circulated to States and Union Territory Governments[3]. One of the salient features of the model APMC act was permitting direct marketing and CFAs. It also laid out rules, whereby there be compulsory registration of all contract farming sponsors, recording of CFAs, resolution of disputes within thirty days without Government of India leading to courts, if any, arising out of such agreement, exemption from levy of market fee on produce covered by contract farming agreement.

At one hand, policymakers are pushing for reforms to facilitate CFAs while on the other hand there are certain sections in the society that are opposed to the notion of CF. For example, Some of the farmer groups across India have opposed CF, as they find it to be exploitative towards farmers. For example, *Rythu Swarajya Vedika,* an umbrella organization of agriculturists and activists has opposed the Andhra Pradesh (AP) Government's move to introduce CF in the State (Times of India, 2012). According to *Vidarbha Janadolan Samiti* in Maharashtra, CF model has not been working well at least for farmers. As many times companies have failed to pick up the whole produce and have been unresponsive towards monsoon failures in setting prices . Similarly, Biswas (2014) reports that some of the organized retailers failed to honour their commitment of procuring exotic vegetables in Pune district during 2010, leaving farmers to sell it at APMC markets at less than the fair price. In 2012, there was an emu[4]scam, whereby emu companies failed to pay the maintenance costs and procure back emu birds across states such as Tamil Nadu, Kerala, Karnataka, and Andhra Pradesh (Ramesh, 2012). Worldwide, there is a concern that faster growth of agro-industries in developing countries poses risks in terms of equity, sustainability, and inclusiveness. The concerns are that whenever there is an unbalanced market power in agri-food chains, and then the value addition and capture can be concentrated among one or a few chain participants to the detriment of the others (Da Silva & Baker, 2009).

Although many papers[5] and Government of India committees[6]; have welcomed CF but they also recommend that there should be a monitoring mechanism and a dispute settlement body to settle disputes in an efficient way. According to Ghosh (2013, p. 78), CF has been viewed with special mistrust in many states and contracts need to be regulated, transparent and judicially redress able, as the fear of unknown is disturbing. Also, National Commission of farmers (2006b, p. 28) points out

[1]*Sivramkrishna & Jyotishi (2008) provide a brief review of literature on monosponistic nature of CFAs.*

[2]*viz. Government of India(2002, 2007);National Commission on Farmers, 2004, 2005, 2006b); Planning Commission (2008; 2013);*

[3]*In India, agriculture being a State subject, so the States had to make the laws for CF.*

[4]*Emu are flightless birds, naïve to Australia*

[5]*Readers can refer to Acharya & Agarwal (2011, p. 224); Ghosh (2013, p. 78); Similarly, Singh (2002) recommends legal protection for contract growers must be considered to shield them fromill-effects of contracting.*

[6]*Government of India (2002; 2007; 2013); Planning Commission (2011c)*

that CF could be biased in favour of the agribusiness organization; hence there is a need for a farmer-centric CF system which is clean and equitable. National Commission on Farmers (2005), second report recommends that appropriate codes of conduct suited to the needs of various stakeholders and confidence building among stakeholders. Similarly, Eleventh Five Year Plan document mentions needs to be backed by ensuring effective mechanisms for contract registration and dispute resolution, along with adequate information and support so that small farmers are able to enter into collective contracts (Planning Commission, 2008). Although, most of the States have amended their respective APMR Act to facilitate direct procurement of agricultural commodities by companies from the farmer's field[7]; but some states such as West Bengal are skeptical about CF(BS Reporters, 2012; ET Bureau, 2012).

Another problem is that although the states have been amending the respective APMR act and rules for making provisions of contract farming, but the response from contracting firms is not that encouraging for example based on Gulati *et al.* (2008); Narayanan (2012), the media reports[8] and interaction with agricultural marketing board officials of the state of Gujarat and Maharashtra, that there are handful of companies that have come forward and registered themselves. As Gulati *et al.*(2008) point out that legal sanctity of contracts maybe needed to help control breach of agreements but it is observed that neither the firm nor the farmers are keen to approach the law. Also, Narayanan (2012) based on her extensive field survey in Southern India, found that both farmers and firms were reluctant to develop formal legal contracts and preferred to continue with transactions outside the prescribed legal-institutional structure. Narayanan further notes that agribusiness firms prefer to call "relationship farming or contract farming" rather than CF. As agribusiness firms are not registering themselves with the prescribed authorities under the APMR Acts of respective State Governments. Thus, there is no data available at State level or national level pertaining to number of companies and farmers involved in CF. Moreover, the data on the crop acreage under CF at State and National level is unavailable in the public domain. Thus, there prevails an ambiguity over the extent to which CFAs are prevailing in the nation. Narayanan (2012) in her paper provides a theoretical understanding of the different enforcement mechanisms pertaining to CF.

In lieu of this background, this present paper (a) reviews the contract farming regulations prescribed by the model APMR Act (2003) and the Rules (2007); (b) identify contentious issues, which are lacuna and building blocks for the effective implementation of the policy; and (c) suggest the remedial measures for the same. To fulfill the objectives of the paper, both the primary and secondary sources data is used. Primary sources of data includes discussions with selected contracting firms[9] and government officials in Maharashtra and Gujarat farmers' and also to know about the problems faced by contract farmers' and awareness of contract farming regulations we rely on survey data of 378 farmers from the first authors' Ph. D. thesis on chip-grade potato and white onion CF in Maharashtra[10]. We argue that better compliance of the CF rules would reduce the amount of troublesome uncertainties in regard to exploitation by contracting firms, and would thereby strengthen the CF system.

Apart from the literature review, the arguments are based on paper is divided as follows: Section 2 reviews the model APMR Act (2003) and the Rules (2007) along with the suggestions. Section 3 suggests the guidelines to make the contract farming regulations more effective and section 4 Concludes. The paper examines the CF regulations as per the model APMR Act prepared by Government of India and implemented by states such as State of Maharashtra and Gujarat. It attempts to identify contentious issues, which would are lacuna and building blocks for the effective implementation of the policy and suggest the remedial measures for the same.

Model APMR Act (2003) and The Rules (2007)

In this section, we review some of the features of contract farming regulations as per the Model APMR Act (2003) and the Rules (2007) prepared by the Union Government of India.

Formal and Informal Contract

A separate chapter has been included in the legislation to regulate and promote contract-farming arrangements in the country. According to The Model Act, 2003 "Contract Farming" means farming by a person called "Contract Farming Producer" under a written agreement with another person called "Contract Farming Sponsor" to the effect that his farm produce shall be purchased as specified in the agreement. This means it only recognizes Contract Farming, which has a written agreement. Although, there are written contract farming agreements practiced by the agribusinesses[11], but there are also many contracting firms which procure without

[7] *As on 07.08.2015, 21 States (Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Maharashtra, Madhya Pradesh, Mizoram, Nagaland, Odisha, Punjab (separate Act), Rajasthan, Sikkim, Telangana, Tripura and Uttarakhand) have amended their APMR Acts to provide for contract farming and of them, only 13 States (Andhra Pradesh, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Maharashtra, Madhya Pradesh, Odisha, Rajasthan and Telangana) have notified the rules to implement the provision (GoI, 2015).*

[8] *Ghadiyalpatil (2008) reports that contracts are not being signed under revised APMC rules by Maharashtra State Agricultural Marketing Board.*

[9] *Officials of Pepsico (I), Jain Irrigation (I) Pvt. Ltd., and Siddhivianyak Agro Pvt. Ltd. in Maharashtra*

[10] *The thesis was done under the guidance of second author. The field study was conducted in Pune and Satara district for chipgrade potato CF and in Dhule and Jalgaon districts of Onion CF. The reference period of field survey was from 2012 to 2013.*

written agreements. In case of tomatoes in Punjab, PepsiCo experienced that written agreement did not serve any additional purpose than just to record the relation. Thus, it had oral contracts (verbal understanding) in case of tomato and basmati paddy, which seemed to work well (Deshpande, 2005). Oral contracts were also prevalent in crops like gherkin, oil palm in AP, (Dev & Rao, 2005); baby corn, chillies, and maize in Karnataka (Nagaraj *et al.,* 2008); similarly, many supermarket chains in Maharashtra procure without any written agreements[12]. Narayanan (2012) found that although there were written contracts in case of papaya in Tamil Nadu, but farmers did not believed that they were legally validity of the same. This means that farmers feel that can sell the produce outside the contract.

Narayanan (2011) in her literature review mention the contract is a very broad representation of the relationship, where agreements on particular aspects are no more than notional. Given the nature of farming, it is impossible to specify every contingency in a way, thus rendering contracts incomplete (Morvaridi, 1995). Moreover, across the globe, it has been observed written contracts were seldom legally enforceable (Minten *et al.*, 2009; Narayanan, 2011; Singh, 2002). Thus, companies try to build the relationship with farmers which is based not on written agreement but on trust.

Moreover, wherever written CF agreements are practiced writing of contracts in India, involves no participation of the farmers. When contracts are written by one party in the form of take-it-or-leave-it contracts, the terms of the transaction are often explicitly in favour of the firm (Banerji & Meenakshi, 2004). The field observations from the first author's thesis observed that Pepsico Fritolay's CFA is written in Marathi (which is the local language) on the stamp paper of ₹20 or ₹100. Some of the important points mentioned in the agreement are with respect to quantity of seeds and its price, buy-back price, quality attributes of produce, etc. However, agreement seems to be biased in favour of, as it doesnot protect the farmers from production risks.

It was found that more than half (53 percent) of the Pepsico's chip-grade potato (CGP) contract farmers sample in 2012 have read or were explained about the terms and conditions of contract in detail. While rest were neither aware about the detailed terms and conditions and nor were they bothered. They just knew that they were buying this much amount of seeds and would have to sell the firm after harvest. They signed the contract. The contract copy is only with CF firm and not the farmer. The farmers felt that it is just a mere formality and for records, which shall facilitate to get a crop loan bank through which they are able to pay working capital requirements of producing CGP. Most of the CGP contract farmers in Maharashtra were sure, company would not do anything even if they default on providing the harvest. For the firm contract helps in, in case farmers go to legal authorities during disputes. Discussion with the field officials of PepsiCo (I) in Maharashtra mention that written contracts are basically to protect its interests in contingencies, for e.g., in case any farmers complains to Government authorities or the law about any action of the firm. Than company shall mention that they have just acted in accordance with the contract signed by both the party.

Authors in his thesis also observed that in case of white onion contract farming in Maharashtra carried out by Jain Irrigation Systems (I) Pvt. Ltd. (JISL), there was no written agreement. JISL is carrying out its white onion contract farming since 2001. As per JISL records, in 2011-12 for Rabi season, it had contracted for 1348 hectares for white onion with around 1926 farmers spread across 8 districts. There is no legal contract involved in this buyback arrangement. Company relies totally on their relationship, trust, and social peer pressure for contract compliance. "JISL official's call their engagement with farmers as contract farming" rather than contract farming. It is a concept where "there is a mutual understanding between the farmer and the company to grow onion".

Based on the literature review and field observations, it is suggested that contract farming regulations should consider oral or informal CFAs.

Poultry and Livestock Sector

Current contract farming regulations do not recognize poultry within contract farming regulations. As pointed out in Deshpande (2005), broilers contract farming was prevalent in India since 1990s. Moreover, it is quite widespread; hence contract farming regulations should also be applicable for poultry sector in order to avoid any potential unwanted incidents in future such as that of emu scam in 2013 in Southern India.

Contract Registration

As per the Model APMR Act, contracting firm has to register itself with a district level authority and record the contract farming agreement along with the number of farmers and crop acreage. Although the States have been amending the APMR Act and rules for making provisions of contract farming, but the response from contracting firms is not that encouraging. For e.g., based on the media reports[13] and interaction with agricultural marketing board officials of the State of Gujarat and Maharashtra, that there are handful of companies that have come

[11] *Written contracts were reported in case of poplar (Deshpande, 2005), and various vegetables in Punjab by Field Fresh (Pandey et al., 2010), marigold in Tamil Nadu (Narayanan, 2011). Singh and Asokan (2003) in their study reported that written contracts for many of the crops were in vernacular languages viz. Kannada for gherkin in Karnataka, Tamil or Telugu for broilers in TN, Gurumukhi for roses and tomatoes in Punjab.*

[12] *Discussion with D. Suganthi, Ph. D. scholar, IGIDR, whose thesis was on super markets in Maharashtra*

[13] *Ghadiyalpatil (2008) reports that contracts are not being signed under revised APMC rules by Maharashtra state Agricultural marketing Board.*

forward and registered themselves with the APMCs. Till 2012, there were around two and nine firms that had registered in Gujarat and Maharashtra respectively. At the time of field survey in 2012-13, it was observed that MNCs such as JISL in Maharashtra and Pepsico who have CFAs in Maharashtra and Gujarat were not registering as contract farming sponsor with the respective APMCs, where contract farming is carried out.

State governments should find ways so as those agribusinesses registers their CFAs. State Governments should hold discussions with the food processing firms/associations or different Chambers of Commerce in their respective States, to find out the suggestion for incentivizing contracting firms to register with respective State/District agencies. State Governments should also incentivize companies in the form waiving or reducing the market fee charged. For example, Karnataka State Agricultural Marketing Board and Gujarat State Agricultural Marketing Board and (GSAMB) has waived of market fee of those registering with it by 30 and 50percent respectively[14].

Overall, if contracting firms provides the necessary details regarding the crop acreage and number of farmers under contract, a database of acreage and crops under contract could be generated. As most of the commodities grown under CF, are those, which are either not available in the APMC market at the required quantity or at right time for the agro-processors. These crops are mostly fibre crops or processing or export-oriented crops. Therefore, in light of the issue of food security, as a policymaker, it is important to know how much area is being diverted to which crops under CF.

Dispute Resolution

The another idea behind contract farming regulation is to create an atmosphere of trust between contracting firm and farmer by providing a time-bound dispute resolution mechanism at the APMC in an event of dispute without Government of India to legal courts.

Planning Commission (2008) states that contract farming needs to be backed by ensuring effective mechanisms for contract registration and dispute resolution, along with adequate information and support so that small farmers are able to enter into collective contracts. Thus, many of the State Government have formed a dispute resolution body at district level for a timely resolution to the dispute occurred during the CFAs. The disputes arising with the farmer should be settled within fifteen days and the decretal amount of appeal should not be more than 10percent of the amount of goods purchased under contract farming (Government of India, 2013).

As per the field survey of the author, the primary survey in selected districts of Maharashtra found that the farmers, unaware of the existence of dispute-settling authorities for CF, and felt helpless whenever a dispute would arise. Thus, when contracting firm does not registers with the district level authority, farmer cannot register their grievance with them. Therefore, State Government should publicise its contract farming policy and rules in order to create awareness for the same with special highlights on benefits of contract farming, the availability of dispute resolution mechanism and indemnity of land, which protects the rights of the farmer. State Governments can use mass media viz. electronic media (Television, radio, etc.), print media (newspapers, periodicals, etc.), as well as through agri-exhibitions to publicise and promote contract farming rules. This shall help in making farmers aware about their rights in CFAs and clear the fears from farmers mind about working with agro-processing/marketing firms.

GSAMB has made a step in writing direction by creating awareness about the contract farming. By uploading the States' contract farming rules, framework of agreement, forms of registration, fees charged, etc. Moreover, it has also uploaded a video highlighting what is CF, what are its benefits, what are the new contract farming rules and its benefits through the interviews of farmers, staff of contracting firms such as those of McCain (I) and Desai cold storages, and that of GSAMB. This is a novel idea of GSAMB.

Environmental Considerations

There has been no mention of any environmental considerations in relation to detrimental effect on environment which may occur due to contract crop cultivation. For e.g., onion growers of Jalgaon and Dhule district were complaining that JISL white onion cultivation leads to loss of soil fertility. In such a scenario: State Government extension services agencies or agricultural institutes, should examine and keep a watch, whether contract crop cultivation has any negative impact on soil fertility and groundwater.

CONCLUSIONS

Overall, this paper reviews the contract farming regulations prescribed by the model APMR Act (2003) and the Rules (2007). Some of the issues pertaining to formal and informal contract, contract registration and dispute settlement have been discussed. It is suggested that informal (oral agreements) be considered as CFAs. Contracts in poultry sector are considered as CFAs and regulations should also be applicable to them. More awareness among farmers and contracting firms is needed to make the contract farming regulations more participatory and inclusive. We argue that better compliance of the CF rules would reduce the amount of troublesome uncertainties in regard to exploitation by contracting firms, and would thereby strengthen the CF system.

[14] *Government of India (2013) and Discussion with GSAMB official in 2014 respectively*

REFERENCES

Acharya, S.S., & Agarwal, N.L. (2011). *Agricultural marketing in India* (fifth ed.). New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.

Asokan, S.R., & Singh, G. (2003). Role and constraints of contract farming in agro-processing industry. *Indian Journal of Agricultural Economics, 58*(3), 466-477.

Banerji, A., & Meenakshi, J.V. (2004). *Millers, commission agents and collusion in grain auction markets: Evidence from basmati auctions in North India.* Working Paper No. 129. Delhi: Delhi School of Economics, Delhi University.

Bijman, J. (2008). *Contract farming in developing countries: An overview.* Wageningen University.

BS Reporters. (2012, June 08). Mamata to open up state's backend retail to private sector. *Business Standard*.

Clapp, R.A. (1994). The moral economy of the contract. In P. D. Little, & W. M. J. (Eds.), *Living under contract: Contract farming and agrarian transformation in Sub-Saharan Africa* (pp. 78-96). The University of Wisconsin Press.

Contract farming government order sows seeds of fear among royts. (2012, August 4). *Contract farming government order sows seeds of fear among royts*. Retrieved from http://timesofindia.indiatimes.com/city/hyderabad/Contract-farming-government-order-sows-seeds-of-fear-among-royts/articleshow/15346582.cms.

Da Silva, C.A., & Baker, D. (2009). Introduction. In C. A. Da Silva, D. Baker, A. W. Shepherd, C. Jenane, & S. Miranda-da-Cruz (Eds.). *Agro-industries for Development* (pp. 1-9). FAO; UNIDO.

Deshpande, C.S. (2005). *Contract farming as means of value-added agriculture.* Occasional Paper - 42, National Bank for Agriculture and Rural Development, Department of Economic Analysis and Research, Mumbai.

Dev, S.M., & Rao, C.N. (2005, June 25). Food processing and contract farming in Andhra Pradesh: A small farmer perspective. *Economic and Political Weekly, 40*(26), 2705-2713.

ET Bureau. (2012, June 12). West Bengal government may amend APMC Act. *Economic Times*.

Ghosh, N. (2013). *India's agricultural marketing: market reforms and emergence of new channels.* New Delhi: Springer.

Glover, D., & Kusterer, K. (1990). *Small farmers, big business: Contract farming and rural development.* New York: St. Martin's Press.

Government of India. (2002). *Report of Inter-Ministerial Task Force on Agricultural Marketing Reforms.* Ministry of Agriculture, Government of India.

Government of India. (2007). *National Policy for Farmers.* New Delhi: Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.

Government of India. (2012a). *Report of the Working Group on Food Processing Industries for the 12th Five Year Plan.* Ministry of Food Processing Industries. Government of India.

Government of India. (2013). *Final Report of Committee of State Ministers, In-charge of Agriculture Marketing to Promote Reforms.* Ministry of Agriculture, Department of Agriculture and Co-operation, Government of India.

Government of India. (2015, August 07). *Question and answer*. Retrieved August 26, 2016, from Parliament of India, Rajya Sabha: http://164.100.47.5/qsearch/QResult.aspx

Gulati, A., Ganguly, K., & Landes, M.R. (2008). Towards contract farming in a changing agri-food system. In A. Gulati, P.K. Joshi, & M.R. Landes (Eds.), *Contract Farming in India:A Resource Book; A Product of Indo-US Knowledge Initiative on Agriculture.* National Centre for Agricultural Economics and Policy Research (NCAP).

Morvaridi, B. (1995). Contract farming and environmental risk: the case of Cyprus. *The Journal of Peasant Studies, 23*(1), 30-45.

Nagaraj, N., Chandrakanth, M., Chengappa, P., Roopa, H., & Chandakavate, P.M. (2008). Contract Farming and its implications for input supply, linkages between markets and farmers in Karnataka. *Agricultural Economics Research Review, 21*(Conference Number), 307-316.

Narayanan, S. (2011). *Contract farming as frictional equilibria: A theoretical perspective with empirical excursions in India.* (Doctoral Thesis). Cornell University, USA.

Narayanan, S. (2012). *Notional contracts: The moral economy of contract farming arrangements in India.* Working paper-2012-20, IGIDR, Mumbai.

National Commission on Farmers. (2004). *Serving farmers and saving farming - First Report.* New Delhi: Ministry of Agriculture, Government of India.

National Commission on Farmers. (2005). *Serving farmers and saving farming: From crisis to confidence, Second Report.* New Delhi: Ministry of Agriculture, Government of India.

National Commission on Farmers. (2006b). *Serving farmers and saving farming, Fifth and Final Report.* New Delhi: Ministry of Agriculture, Government of India.

Pandey, M., Sudhir, K., Ahuja, R., & Tewari, D. (2010). *Field-fresh foods: linking Indian fields to the world.* Retrieved from https://www.scribd.com/document/145462861/Food-Lingking-Indian-Field-Toworld.

Planning Commission. (2008). *Eleventh Five Year Plan (2007-12) Volume III Agriculture, rural development, industry, services, and physical infrastructure.* New Delhi: Planning Commission; Government of India.

Planning Commission. (2011). *Faster, sustainable and more inclusive growth: An approach to Twelfth Five-Year Plan.* New Delhi: Government of India.

Planning Commission. (2011c). *Report of the working group on agricultural marketing infrastructure, secondary agriculture, and policy required for internal and external trade for the XIIth Five Year Plan 2012-17.* Planning Commission, Agriculture Division. Government of India.

Planning Commission. (2013). *Twelfth Five Year Plan (2012–2017) economic sectors.* New Delhi: Planning Commission (Government of India).

Raja, A. (2011, December 1). Contract farming not helping in farmers. *India Today*.

Ramesh, S. (2012, August 13). The rise and fall of emu farming. *The Hindu*.

Singh, S. (2002). Contracting out solutions: political economy of contract farming in the Indian Punjab. *World Development, 30*(9), 1621-1638.

Sivramkrishna, S., & Jyotishi, A. (2008). Monopsonistic exploitation in contract farming: articulating a strategy for grower cooperation. *Journal of International Development, 20*(3), 280-296.

Appendix
Partial list of companies which have adopted contract farming.

State	Crops	Company
Maharashtra (Ratnagiri and Sindhudurg districts)	Patchouli (Aromatic oil plant)	S. H. Kelkar Group of companies
Maharashtra	White Onion	Jain Irrigation
Maharashtra	Many Crops	Mahindra Shublabh
Maharashtra	Winery grapes	Champagne (I) Ltd & many other wineries
Maharashtra	Table variety grapes	Tata Chemicals
Maharashtra (Ambegaon taluka, Pune district)	Fodder for 3500 cows	Gowardhan Dairy
Maharashtra (Junnar taluka, Pune district)	red onion	Panchganga
Maharashtra (Junnar; 150 Farmers) Maharashtra (Wardha, Yavatmal)	Banana Cotton	GargiAgribiotech 12 companies
Maharashtra, MP, Gujarat, Karnataka, Chattisgarh, Rajasthan	Safflower	Marico
Maharashtra (650 farmers, 1200 acres Nashik district)	Tomato	Varun Foods
Maharashtra, Andhra Pradesh (AP), TN;	Broiler	Sri. Venkateshwara Hatcheries; Swathi Hatcheries; Pioneer; Suguna Poultry
Maharashtra, Gujarat, Punjab, West Bengal, Karnataka	Potatoes,	Pepsi Co (I)
Maharashtra, TN, MP, Gujarat, Haryana,	Organic products of banana, potato, wheat, papaya, basmati, cotton	Ion Exchange Enviro Farms Ltd.
Maharashtra, Punjab, UP, MP, , Karnataka	Basmati, Wheat, Fruits, and Vegetables	Rallis
Karnataka	Marigold, Caprica Chilly	AVT Natural Products Ltd
Andhra Pradesh	guar	Agrilogix
Gujarat; Punjab; Lahaul Spiti (HP)	Sesame seeds; Potato; Seed potato	McCain (I) Ltd
Karnataka and other adjoining area in other states	herbs	Rosun Naturals Products Pvt. Ltd.
Karnataka, AP	Gherkin, baby corn, paprika	Global Greens, Sterling Agro Products, Ken Agritech,GreenAgri Pack, Unicorn AgroTech
Karnataka, Tamil Nadu	Organic Cotton	Appachi Cotton Company
Madhya Pradesh	Wheat, Maize and Soybean	Cargill India Pvt Ltd
Madhya Pradesh	Wheat	HLL
Madhya Pradesh	Soyabean	ITC - IBD
Madhya Pradesh	Pomegranate	Sanjeevani Orchards
Punjab	Chilies, Basmati, Groundnut	PepsiCo
Punjab	Tomato and chilies	Nijjer Agro Foods
Punjab	Basmati	Satnam Overseas, Escorts
Punjab	Milk	Nestle
Punjab, Rajasthan, UP and Maharashtra (200 farmers)	Baby corn, sweet corn	Bharti Del Monte
Rajasthan	Barely	SAB-Miller (I)
Rajasthan	Guar	Vikas WSP Ltd
Rajasthan (1300 farmers)	Barley	UB Group through PepsiCo
TN	Paddy (Branded rice Ponni)	EID Parry

Source: Adapted from electronic and print media sources

The list of companies (Appendix) which are carrying out contract farming has been compiled through different sources of literature such as through website of Ministry of Agriculture, Government of India, Ministry of Food Processing, Government of India, NABARD, MSAMB, and other print and electronic sources. The list is incomplete and was during the course of doctoral dissertation of the author. Hence, currently not sure which among them is non-functional?

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 113-119
DOI: 10.5958/2322-0430.2018.00120.8

NAAS Score: 4.82
www.naasindia.org
UGC Approved

An Economic Analysis of Potato Seed Production in Haryana[#]

Ashu[1], Dalip Kumar Bishnoi[2], Jitender Kumar Bhatia[2] and O.P. Sheoran[3]*

[1]Research Scholar, [2]Assistant Scientists, Department of Agricultural Economics, and [3]Professor (Statistics) Department Computer Science, CCS Haryana Agricultural University, Hisar-125004

[*]Corresponding author's email: dalipbishnoi@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-103* *Revision Accepted: March 10, 2018*

ABSTRACT

The study revealed that the per acre total cost of cultivation of potato seed production in small, medium and large categories for contract farmers were estimated to be ₹70486 ₹71234, and ₹72778 respectively. Further, the total cost estimated for small, medium and large categories basis for non-contract farmers were ₹63651, ₹65946, and ₹66459 respectively. These results clearly advocated that the total cost of seed production is much higher for all the categories of contract farms over non-contract farmers. This may be due to overutilization of resources such as seed, plant protection charges, human and tractor labour by the contract farmers.Whereas per acre net returns of small, medium and large categories of contract farmers obtained from potato seed production were ₹36089, ₹36958 and ₹35250 respectively, Similarly per acre net returns of small, medium and large categories non-contract farmers obtained from potato seed cultivation were ₹14471, ₹14711 and ₹13602 respectively. It is clearly evident from the results that per acre net return were high in all categories of contract farmers as compared to non-contract farmers. The may be due to the higher yield on contract farming which was mainly because of use of superior quality and proper quantity of inputs such as seeds and chemicals as well as following proper guidelines of package of practices provided by the contractual agency. In nutshell, the potato seed production was found to be profitable with the adoption of contract farming due to the remunerative price on one hand and an increase in yield on the other which reduced their yield and price uncertainty. Therefore, use and adoption of contract farming needs to be expanded among all the potato seed growers.

Keywords
Contract farming, predetermined prices, price stability, firms.

JEL Codes
C81, Q12, Q18.

INTRODUCTION

Potato is the most important food crop of the world, which has always been the poor mans' crop. Potato is being cultivated in the country for the last more than 300 years. For vegetable purposes, it has become one of the most popular crops in the country. Potato is a wholesome food which is rich in carbohydrates, proteins, minerals, and vitamins. It is a rich source of potassium and very good for patients suffering from heart ailments. It contains 22.6 percent carbohydrates, 1.6 percent protein, 0.1 percent fat, 0.4 percent crude fibre and 97 (kcal) calories (National Horticulture Board). Potato is used for several industrial purposes such as for the production of starch and alcohol, etc. Potato starch (farina) is used in laundries and for sizing yarn in textile mills. Potato is also used for the production of dextrin and glucose. Keeping in view the shrinking cultivable land and burgeoning population in India, potato is a better alternative to deal with the rising food demand.

India ranks third in area and second in production in the world after China. At world level, about 365.36 million tonnes of potato is produced. This production is obtained over an area of about 19.28 million hectare. The major potato growing countries in the world are China, Russia, India, USA, Germany, Poland, Ukraine, U.K., Turkey, Iran, Netherlands, France, New Zealand and

[#]Paper is the part of M.Sc. thesis of first author submitted to CCS Haryana Agricultural University, Hisar.

Belgium. New Zealand occupied first rank in production of potato with 50.14 tonnes per hectare followed by USA (45.82 t/ha) and Belgium (45.42 t/ha) (National Horticultural Research and Development Foundation, 2005).

India had achieved approximately 43.42 million tonnes of production within a limited area of 2.12 million hectare during the year 2015-16.Maximum potato production takes place in Uttar Pradesh (13.85 million tonnes) followed by West Bengal (8.43 million tonnes), Bihar (6.34 million tonnes), Gujarat (3.55 million tonnes), Madhya Pradesh (3.16 million tonnes), Punjab (2.38 million tonnes), Assam (1.04 million tonnes), Haryana (0.85 million tonnes) and Chhattisgarh (0.64 million tonnes) respectively. Productivity is highest in Gujarat (31.58 t/ha) followed by Punjab (25.83 t/ha), Haryana (24.91 t/ha), Uttar Pradesh (22.81 t/ha), Madhya Pradesh (22.41 t/ha) and Maharashtra (20.12 t/ha). Uttar Pradesh has highest share both in area 6.07 lakh hectare (28.67percent) and production 13.85 million tonnes (31.90 percent). Total area under potato cultivation estimated around 1.24 percent (21.17 lakh/ha) more as compared to last year's area of 20.75 lakh ha. Total production of potato in the current year estimated less by around 1.11 percent (43.42 million tonnes) as compared to last year's production of 48.01 million tonnes. India and China even being a major potato producing countries has quite low productivity of 21.75 t/ha and 16.12 t/ha respectively.

The area, production, and productivity of potato in Haryana were 34.27 thousand hectare, 853.80 thousand tonnes and 24.38 tonnes per hectare respectively during the year 2015-16. In Haryana, potato has got a prominent place and holds the first position among the other vegetable crops with respect to area and production under different vegetables. In Haryana, it is grown mainly in the districts like Kurukshetra, Yamunanagar, Karnal, Sonipat, Ambala, Panchkula, Panipat, Rohtak, Jind and Sirsa (Directorate of Horticulture Research, 2015-16).

The contract farming is emerging as an important tool for reducing risk in crop production and minimizing price uncertainty of the produce. As it is a new mechanism in Indian agriculture, it needs to be studied in detail whether involvement of the corporate sector in agriculture is beneficial to the producers/farmers. Thus the study was planned and undertaken in Haryana

METHODOLOGY

The study was undertaken in Karnal district of Haryana keeping in view the highest area under potato contract farming. From the selected district, Gharaunda and Indri blocks having the largest area under the potato cultivation were selected for the study. Three villages were selected from each block having highest area under contract farming and non-contract farming. These villages were Arrainpura, Bassi Akbarpur, and Faridpur in Gharaunda block whereas Khanpur, Jaipur, and Phoosgarh from Indri block in Karnal district. Total 90 farmers were selected randomly comprising of 45 each for contract and non-contract potato growers from the Karnal district. The tabular form of analysis was adopted to analyze the general economic feature of the sample farmers, cost structure, resource structure, costs and returns and opinion of farmers regarding the problems in production and marketing. The tabulation was made separately for categories of contract and non-contract farmers.

RESULTS AND DISCUSSION

Socio-economic Profiles of the Respondents

Socio-economicstatus of the selected respondents are presented in Table 1. In a group of 45 contract farming families, there were a total of 283 family members. Among these, percentage of adult males, adult females, children males, children females were 39.57, 24.73, 20.85 and 14.84, respectively. Similarly, the total number of family members in a group of 45 non-contact farming families were 298 and among the adult males, adult females, children male & females were 38.44, 24.10, 21.82 and 13.09 percent, respectively**.** As far as educational status of the selected respondents was concerned, more than ninety percent were found literate, whereas only 7.78 percent were illiterate. Among literate, more than sixty percent potato grower were educated up to secondary level followed by senior secondary (25.55 percent) and graduate (5.55 percent), respectively

It was clearly indicated from Table 1 that among the selected respondents, more than sixty percent respondents were falling in between the age group of 38-55 years, followed by young age (18.89 percent)and old age group (16.67 percent), respectively.

Economics of Potato Seed Production on Small Size Farms

A comprehensive view on the economics of the potato seed production on small size farms are presented in Table 2. The per acre total cost were found to be ₹70486 and ₹63651 on contract and non-contract potato seed growers, respectively. Whereas per acre variable cost was estimated to be ₹42728 and ₹35038 on contract as well as non-contract potato seed growers, respectively. The gross returns were observed ₹1, 06,575 in case of contract farmers whereas it was ₹78122 in the case of non-contract farmers. The returns over variable cost for contract and non-contract potato seed growers were worked out to be ₹63847 and ₹43084 respectively, whereas net returns were observed ₹36089 and ₹14471, respectively.

In the case of contract potato seed growers, the maximum share in cost of cultivation were observed by rental value of land (27.26 percent) followed by seed (27.23percent) and so on. Similarly, in case of non-contract farmers, highest share in total cost of cultivation were reported by rental value of land (30.54percent) followed by seed (20.51percent) and so on. The per acre average potato seed production were found 147 and 142 q per acre for contract and non-contract potato seed growers, respectively. The cost of production comes out to be ₹479 and ₹448 per quintal on contract and non-

contract farmers, respectively. The benefit-cost ratio was estimated 1.51 and 1.23 for contract as well as non-contract potato seed growers, respectively. Similar results were observed by Tripathi *et al.* (2005) and Khemar *et al.* (1994) in their study.

Economics of Potato Seed Production on Medium Size Farms

Economics of the potato seed production on medium-sized farms are presented in Table 3. The per acre total cost were found to be ₹71234 and the ₹65946 on contract and non-contract potato seed growers, respectively. Whereas per acre variable cost were estimated to be ₹43320 and ₹37003 on contract as well as non-contract potato seed growers, respectively. The gross returns were observed ₹1, 08,192 in the case of contract farmers whereas it was ₹80657 in the case of non-contract farmers. The return over variable cost for contract and non-contract potato seed growers were evident ₹64872 and ₹43654, respectively, whereas net returns were observed ₹36958 and ₹14711, respectively.

In case of contract potato seed growers, the maximum share in cost of cultivation was observed by seed (27.49 percent) followed by rental value of land (27.02percent) and so on. Similarly, in case of non-contract farmers, highest share in total cost of cultivation were reported by rental value of land (29.25percent) followed by seed (21.92percent) and so on. The per acre average potato seed production were found 149 and 144 q per acre for contract and non-contract potato seed growers, respectively. The cost of production was found₹478 and ₹458 per quintal on contract and non-contract farmers, respectively. The benefit-cost ratio was estimated 1.52 and 1.22 for contract as well as non-contract potato seed growers, respectively. Similar results were observed by Buvaneshwaran & Banumathy (2008) in their study.

Economics of Potato Seed Production on Large Size Farms

Economics of the potato seed production on large size farms are presented in Table 4. The per acre total cost were found to be ₹72778 and the ₹66460 on contract and non-contract potato seed growers, respectively. Whereas per acre variable cost were estimated to be ₹44636and ₹37382 on contract as well as non-contract potato seed growers, respectively. The gross returns were observed ₹1,08,025 in the case of contract farmers whereas it was ₹80061 in the case of non-contract farmers. The return over variable cost for contract and non-contract potato seed growers were evident ₹63389 and ₹42677 respectively, whereas net returns were observed ₹35250and ₹13602, respectively.

In the case of contract potato seed growers, the maximum share in cost of cultivation was observed by seed (27.48 percent) followed by rental value of land(26.40percent) and so on. Similarly, in case of non-contract farmers, highest share in total cost of cultivation were reported by rental value of land (28.84percent) followed by seed (22.07percent) and so on. The per acre average potato seed production were found 148 and 143 q per acre for contract and non-contract potato seed growers, respectively. The cost of production was found ₹492 and ₹465 per quintal on contract and non-contract farmers, respectively. The benefit-cost ratio was estimated 1.48 and 1.20 for contract as well as non-contract potato seed growers, respectively. These results are at par with the previous study of Dileep *et al.* (2002).

Table 1. Family composition of respondents in Karnal district of Haryana

(1) Family composition of respondents			
Particular	**Contract farmers**	**Non-contract farmers**	**Overall total**
Adult male	39.57	39.60	39.59
Adult female	24.74	24.83	24.78
Children (M)	20.85	22.48	21.69
Children (F)	14.84	13.09	13.94
Total	100.00	100.00	100.00
(2) Distribution of respondents according to their education status			
Illiterate	6.67	8.89	7.78
Up to secondary	62.22	60.00	61.11
Up to Senior Secondary	26.67	24.44	25.55
Graduate	4.44	6.67	5.55
Total	100.00	100.00	100.00
(3) Distribution of respondents according to their age group			
Young (Up to 37)	17.78	20.00	18.89
Middle (38-55)	62.22	66.67	64.44
Old (above 55)	20.00	13.33	16.67
Total	100.00	100.00	100.00

Figures in parentheses indicate the sample size.

CONCLUSIONS

The study was undertaken in Karnal district of Haryana. Further two blocks namely Gharaunda and Indri were selected out of six blocks of Karnal District. In Gharaunda block three villages namely Arrainpura, Bassi Akbarpur, Faridpur whereas villages Khanpur, Jainpur and Phoosgarh were selected from Indri block in Karnal district. Total ninety farmers, forty-five from each contract as well as non-contract were interviewed for the study. The study revealed that the per acre total cost of

Table 2. Economics of potato seed production on small size farms in Haryana

(₹/acre)

Inputs	Contract farmers			Non-Contract farmers		
	Quantity	Value	Percent	Quantity	Value	Percent
Preparatory tillage	10.46	3150	4.47	10.42	3125	4.91
Pre-sowing irrigation	1	319	0.45	1	296	0.47
Seed (q/acre)	**16.65**	**19192**	**27.23**	**13.38**	**13058**	**20.51**
Seed treatment (gm)	110.96	181	0.26	35	58	0.09
Sowing andridging	1	2073	2.94	1	2104	3.31
FYM	0.83	1212	1.72	0.79	1313	2.06
Fertilizer nutrients (units)						
Urea (kg)	100	580	0.82	95	550	0.86
DAP (kg)	123.74	2846	4.04	138.5	3186	5.01
MOP (kg)	25.93	389	0.55	34.5	515	0.81
Zinc (kg)	5.00	125	0.18	6.04	151	0.24
Total fertilizer investment	**254.67**	**3940**	**5.59**	**274.0**	**4402**	**6.92**
Fertilizer application	5.54	222	0.31	5.92	296	0.47
Irrigation	3.31	992	1.41	3.2	963	1.51
Hoeing/weeding						
Herbicide chemical (gm)	230.25	1058	1.50	154.0	598	0.94
Manual	1	313	0.44	1	279	0.44
Herbicide application cost (tanks)	7.5	151	0.21	7.48	150	0.24
Plant Protection measures						
Pesticide chemical (gm)	220.25	1071	1.52	145.6	552	0.87
Manual	–	–	–	–	–	–
Pesticide application cost (tanks)	7.6	153	0.22	7.64	153	0.24
Digging		4688	6.65		4383	6.89
Miscellaneous		485	0.69		415	0.65
Total (1 to 13)		**39200**	**55.61**		**32145**	**50.50**
Interest on working capital @9 percent		3528	5.01		2893	4.55
Variable cost		**42728**	**60.62**		**35038**	**55.05**
Management charges @10 percent		4273	6.06		3504	5.51
Risk factor @10 percent		4273	6.06		3504	5.51
Transportation		–	–		2167	3.40
Rental value of land		19212	27.26		19438	30.54
Total cost		**70486**	**100.00**		**63651**	**100.00**
Production (q)						
Main		**147**			**142**	
By Product		–			–	
Storage cost (₹/q)		–			60	
Gross returns (₹)		**106575**			**78122**	
Returns over variable cost (₹)		**63847**			**43084**	
Net returns (₹)		**36089**			**14471**	
Cost of production (₹/q)		**479**			**448**	
B:C Ratio		**1.52**			**1.23**	

cultivation of potato seed production in small, medium and large categories for contract farmers were estimated to be ₹70486 ₹71234 and ₹72778 respectively. Further, the total cost estimated for small, medium and large categories basis for non-contract farmers were ₹63651, ₹65946 and ₹66459 respectively. These results clearly advocate that the total cost of seed production is much higher for all the categories of contract farms over non-contract farmers. This may be due to overutilization of resources such as seed, plant protection charges, human and tractor labour by the contract farmers.

Whereas per acre net returns on small, medium and large categories of contract farmers obtained from potato seed production were ₹36089, ₹36958 and ₹35250

Table 3. Economics of potato seed production on medium-size farms in Haryana

(₹/acre)

Inputs	**Contract farmers**			**Non-Contract farmers**		
	Quantity	**Value**	**Percent**	**Quantity**	**Value**	**Percent**
Preparatory tillage	10.42	3075	4.23	10.67	3175	4.81
Pre-sowing irrigation	1	325	0.46	1	304	0.46
Seed (q/acre)	**16.83**	**19583**	**27.49**	**14.42**	**14458**	**21.92**
Seed treatment (gm)	110	183	0.26	60	100	0.15
Sowing &ridging	1	2083	2.92	1	2192	3.32
FYM	0.92	1375	1.93	1	1500	2.27
Fertilizer nutrients (units)						
Urea (kg)	104	604	0.85	110.42	640	0.97
DAP (kg)	126.65	2913	4.09	139.58	3210	4.87
MOP (kg)	29.17	406	0.57	33.33	500	0.76
Zinc (kg)	4.58	115	0.16	0.50	125	0.19
Total fertilizer investment	**264.40**	**4038**	**5.67**	**288.33**	**4475**	**6.79**
Fertilizer application	5.67	227	0.32	5.46	273	0.41
Irrigation	3.42	1025	1.44	3.33	1000	1.52
Hoeing/weeding						
Chemical (gm)	251.69	1092	1.53	165.23	575	0.87
Manual	1	317	0.45	1	283	0.43
Herbicide application cost (tanks)	7.4	152	0.21	7.2	151	0.23
Plant protection measures						
Chemical (gm)	248.52	1096	1.54	151.60	571	0.87
Manual	–	–	–	–	–	–
Pesticide application cost (tanks)	7.3	151	0.21	7.2	149	0.23
Digging		4550	6.39		4279	6.49
Miscellaneous		471	0.66		463	0.70
Total (1 to 13)		**39743**	**55.79**		**33948**	**51.48**
Interest on working capital @9percent		3577	5.02		3055	4.63
Variable cost		**43320**	**60.81**		**37003**	**56.11**
Management charges @10percent		4332	6.08		3700	5.61
Risk factor @10percent		4332	6.08		3700	5.61
Transportation		–	–		2250	3.41
Rental value of land		19250	27.02		19292	29.25
Total cost		**71234**	**100.00**		**65946**	**100.00**
Production (q)						
Main		**149**			**144**	
By-product		–			–	
Storage cost (₹/q)		–			60	
Gross returns (₹)		**108192**			**80657**	
Returns over variable cost (₹)		**64872**			**43654**	
Net returns (₹)		**36958**			**14711**	
Cost of Production (₹/q)		**478**			**458**	
B:C Ratio		**1.52**			**1.22**	

Table 4. Economics of potato seed production on large size farms in Haryana (₹/acre)

Inputs	Contract farmers			Non-Contract farmers		
	Quantity	Value	Percent	Quantity	Value	Percent
Preparatory tillage	10.71	3214	4.22	10.33	3100	4.66
Pre-sowing irrigation	1	321	0.44	1	300	0.45
Seed (q/acre)	**17**	**20000**	**27.48**	**14.67**	**14667**	**22.07**
Seed treatment (gm)	120	200	0.27	66.67	111	0.17
Sowing &ridging	1	2114	2.90	1	2144	3.23
FYM	0.71	1071	1.47	1	1500	2.26
Fertilizer nutrients (units)						
Urea (kg)	114.3	663	0.91	111.11	644	0.97
DAP (kg)	124.83	2871	3.94	136.11	3131	4.71
MOP (kg)	39.3	589	0.81	36.11	542	0.82
Zinc (kg)	5.7	143	0.20	5.56	139	0.21
Total fertilizer investment	**284.13**	**4266**	**5.86**	**288.89**	**4456**	**6.70**
Fertilizer application	6.36	254	0.35	5.5	275	0.41
Irrigation	3.57	1071	1.47	3.22	967	1.46
Hoeing/weeding						
Herbicide chemical (gm)	290.23	1150	1.58	180.04	594	0.89
Manual	1	286	0.39	1	272	0.41
Herbicide application cost (tanks)	7.5	150	0.21	7.5	150	0.23
Plant protection measures						
Pesticide chemical (gm)	289.23	1150	1.58	165.52	589	0.89
Manual	–	–	–	–	–	–
Fungicide application cost (tanks)	7.4	153	0.21	7.3	151	0.23
Digging		5036	6.92		4578	6.89
Miscellaneous		514	0.71		442	0.67
Total (1 to 13)		**40950**	**56.27**		**34296**	**51.61**
Interest on working capital @ 9percent		3686	5.06		3087	4.65
Variable cost		**44636**	**61.34**		**37383**	**56.25**
Management charges @1percent		4464	6.13		3738	5.62
Risk factor @10percent		4464	6.13		3738	5.62
Transportation		–	–		2433	3.66
Rental value of land		19214	26.40		19167	28.84
Total cost		**72775**	**100.00**		**66460**	**100.00**
Production (q)						
Main		**148**			**143**	
By-product		–			–	
Storage cost (₹/q)		–			80	
Gross returns (₹)		**108025**			**80061**	
Returns over variable cost (₹)		**63389**			**42677**	
Net returns (₹)		**35250**			**13602**	
Cost of production (₹/q)		**492**			**465**	
B:C Ratio		**1.48**			**1.20**	

respectively, Similarly per acre net returns on small, medium and large categories non-contract farmers obtained from potato seed cultivation were ₹14471, ₹14711 and₹13602respectively.

It is clearly evident from the results that per acre net return were high in all categories of contract farmers as compared to non-contract farmers. The may be due to the higher yield on contract farming which was mainly because of use of superior quality and proper quantity of inputs such as seeds and chemicals as well as following proper guidelines of package of practices provided by the contractual agency. In nutshell, the potato seed production was found to be profitable with the adoption of contract farming due to the remunerative price on one hand and an increase in yield on the other which reduced their yield and price uncertainty.

REFERENCES

Buvaneshwaran, P., & Banumathy, V. (2008). Economics of lilium production under contract farming in the Nilgiridistrict, Tamil Nadu. *Agricultural Economics Research Review, 21*, 434.

Dileep, B.K., Grower, R.K., & Rai, K.N. (2002). Contract farming in tomato: An economic analysis. *Indian Journal of Agricultural Economics, 52*(2), 197-210.

Directorate of Horticulture Research, Panchkula. (2015-16). Retrieved from http://hortharyana.gov.in.

Khemar, S.H., Nawadkar, D.S., & Dangat, S.B. (1994). Profitability of tomato cultivation in Ahmednagar district of Maharashtra state. *Indian Journal of Agricultural Marketing, 8*(1): 96-100.

National Horticultural Research and Development Foundation, New Delhi. (2005). Retrieved from www.nhrdf.org.

Tripathi, R.S., Singh, R., & Singh, S. (2005). Contract farming in potato production: An alternative for managing risk and uncertainty. *Agricultural Economics Research Review,18*, 47-60.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 120-126
DOI: 10.5958/2322-0430.2018.00045.8

NAAS Score: 4.82
www.naasindia.org
UGC Approved

An Economic Analysis of Pulses Production in Haryana

Kamal[1#], Jitender Kumar Bhatia[2], Dalip Kumar Bishnoi[2] and Nitin Bhardwaj[2]*

[1]*Research Scholar, and* [2]*Assistant Scientists, Department of Agricultural Economics*
CCS Haryana Agricultural University, Hisar-125004

[*]*Corresponding author's email: dalipbishnoi@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-104* *Revision Accepted: February 23, 2018*

ABSTRACT

The study revealed that the total cost of cultivation was lowest on large farms (₹13356.85) and followed by small (₹13525) and medium farms (₹13533.54). Less cost of cultivation on large farms may be due to efficient use of available resources, that is, machine power, manures, fertilizers, plant protection etc. by large farmers as compared to medium and small category farmers. The productivity of moong was highest on small farms (3.47q/acre), which was followed by medium (3.41 q/acre) and large farms (3.34 q/acre). The reason for a little higher productivity on the small farm was observed due to better care and management of crop on account of the small area under it. The net returns per acre were highest on large farms (₹1944.47) followed by medium (₹1924.41) and small farms (₹1815). Whereas in case of Chickpea, cost of cultivation per acre of small, medium, large and overall farms were ₹13921, ₹13533.90, ₹13163.33 and ₹13700.25 respectively. The total cost of cultivation was lowest on large farms and followed by the small and medium farm. Gross returns from chickpea for of small, medium and large were worked out to ₹15969, ₹15782.6 and ₹15404.31 per acre respectively. Among different categories of farmers, large farmers showed highest net returns per acre (₹2241) followed by medium (₹2249)and small categories (₹2048) respectively. Overall net returns on respondent farms were ₹2131 per acre. Small and medium-size farmers got lower net returns as compared to large farmers. It is due to high retention capacity of large farmers while other categories, that is, small and medium farmers are having a higher proportion of distress sale which leads to decreased bargaining power as well as the lower price received. The area of pulses showing declining trend over the years in the state and pulses are very important food for human and feed for live stocks, therefore, the government should ensure remunerative prices and procurement of pulses so that area and production of pulses could increase to meet-out domestic demand of pulses in the state.

Keywords
Gross returns, net returns, productivity, remunerative prices, total cost.

JEL Codes
C81, D61, Q12.

INTRODUCTION

In post-independence era, India has experienced many changes in agricultural development and green revolution was most spectacular. Food grains production increased manifold due to increase in irrigated area, cropping intensity, consumption of chemical fertilizers, insecticides, pesticides, high yielding varieties of seeds and management practices. The production of cereals has registered higher positive compound growth rate as compared to the production of pulses in India during the last five decades. Thus, though India has made a significant headway in increasing agricultural production in general, pulses have continued to evade solutions for people diet. As a result, largest producing country continuously becomes deficient in pulses production.

India primarily produces a variety of pulse crops like chickpea, lentil (Masur), red gram (tur), black gram (urad) and green gram (moong). Pulses account for around 20 per cent of the area under food grains and contribute around 7-8 per cent of the total food grains production in the country. The contribution of Rabi season pulses to the total pulse production is more than Kharif season pulses.

[#]***This paper is part of M.Sc. The thesis of the first author submitted to the CCS Haryana Agricultural University, Hisar-125004.***

The area under pulses in India has increased from 19.09 million hectares in 1950-51 to 23.1 million hectares in 2014-15, showed an increase of 21 per cent whereas the production of pulses during the same period has increased from 8.41 million tonnes to 17.19 million tonnes an increase of over 100 per cent. Similarly, the productivity has increased from 441 kg/ha in 1951 to 744 kg/ha in 2014-15 (Directorate of Economics and Statistics, 2015).

In India, the production of pulses has not been able to keep pace with their domestic demand, resulting in imports of 4-5 million tonnes of pulses per annum, especially from the countries like Canada, Myanmar, and Australia to meet its domestic requirement, however, exports a large quantity of chickpea to countries like Pakistan, Turkey, etc. In pulses, no intensive irrigation is required and these are mostly grown under rain-fed conditions thus, pulses are grown in areas left after satisfying the demand for cereals/cash crops. Even in rain-fed conditions, pulses give a better benefit-cost ratio. Pulses have several other qualities like higher protein content, suitable in various cropping methods as an inter-crop, mixed crop, crop rotations, improve soil chemical and physical property, green pods can be used as vegetables and provide nutritious fodder for animals as well.

Pulse crops, however, experienced a poor status in crop pattern of Haryana and only 1.68 per cent of Area was devoted to pulse sector during the year 2014-15.Haryana has ninth rank in area and production, 1.99 per cent and 2.71 per cent respectively and the third rank in productivity after Tamil Nadu and Gujarat, in total pulses. In Haryana, the area under pulses was 11.5 lakh hectares with the production of 5.63 lakh tonnes during the year 1966-67 which declined to 83.8 thousand hectares with 54.5 thousand tonnes production in 2014-15 (Department of Economic and Statistical Analysis, 2016).

Gram, green gram, pigeon pea, masar, mash are the most important pulse crops grown in Haryana. The neglect of pulses is reflected in their declining share in total foodgrains output from over 21.72 per cent five decades ago to just 0.35 per cent in the year 2014-15 because farmer cultivates pulses in the most marginal conditions and provide least inputs.

Gram (*Cicerari etinum* L.) is commonly known as "Bengal gram" occupies about 77.68 per cent of the area under pulses and contributes about 77.06 per cent of the total pulse production of Haryana, so the gram is the most important pulse crop grown in Haryana. Gram presently occupies an area of 65.1 thousand hectares with 42 thousand tonnes production in Haryana. The major gram growing districts in Haryana are Bhiwani, Hisar, Mahendergarh, Sirsa, Jhajjar including Rewari, Fatehabad etc. Higher productivity of chickpea is obtained in Sirsa district (962 kg per hectare). Green gram (*Vignara diata*) is popularly known as “moong” presently occupies an area of 6.8 thousand hectares with 3.3 thousand tonnes production in Haryana and the productivity of green gram is 509kg/ ha. The green gram growing districts are Hisar, Bhiwani, Sirsa, and Fatehabad (Directorate of Economics and Statistics, 2015-16).

Keeping in view, the multifarious importance of pulses, the area under these crops needs to be increased. The decrease in production and shrinkage in the area of pulse crops in Haryana since its inception, as a consequence of the green revolution, is a cause of great concern. Also, the reduction in the production of pulses is undesirable from the nutritional point of view since a large population of Haryana is vegetarian. The widening gap between supplies and requirement of pulses is well reflected in the soaring prices and falling per capita consumption of these protein-rich food crops. There is the inadequacy of marketing facilities for pulses. Under the existing marketing system, farmers are even getting the price lower than minimum support price in major markets of Haryana. Visualizing the importance of the pulses, an attempt has been made to examine the prevalent marketing systems, marketing cost, margins and price spread in different marketing channels and major constraints faced by pulse growers.

MATERIAL AND METHODS

The present study was conducted in major pulse growing districts of Haryana state having the highest area under pulse crops, were purposively selected for economic analysis of production and marketing of pulse crops during 2015-16. Both primary, as well as secondary data, have been collected and used for attaining the objectives of the study undertaken. Bhiwani & Hisar districts of Haryana were selected purposely having the highest area under pulse crops cultivation. One major pulse growing block from each district was selected on the basis of maximum area and production i.e. Siwani and Hisar II from Bhiwani and Hisar, respectively. Three villages were selected randomly from each block. These villages were Mohila, Sherpura, and Ganda was in Siwani block whereas Kharia, Burak, and Bandaheri from Hisar II block. From the selected villages, random samples of 15 respondents from each village were selected. Then, selected farmers were divided into three categories i.e. small, medium and large farmers based upon their operational size of land holding by using standard classification given by Department of Land Resources, Government of India. In all, 90 farmers distributed into three operational sizes of holding were selected to study the economics of moong and gram production. The tabular analysis was done to analyze the general economic characteristics of the sample farmers, determine the resource structure, cost structure, returns, profits in the production of moong and gram.

RESULTS AND DISCUSSION

Cost and Returns of Moong and Gram on Small Farms

The distribution of costs and returns per acre on small farms is given in Table 1. The gross return from moong and gram on small farms were estimated at ₹15341.00 and

₹15969.02per acre, while the total cost of cultivation was ₹13525.00 and ₹13921.26, respectively. The return over variable cost from moong and gram were ₹8303 and ₹8678.03 per acre, respectively. The net returns from moong and gram were ₹1815.00 and ₹2047.76 per acre, respectively. The average production from moong and gram on small farms were found to be 3.47 and 2.85 quintals per acre and the cost of production per quintal was estimated to ₹3894.00 and ₹4877.16, respectively. The most important cost component in moong and gram were the rental value of land which accounted for 36.23 and 35.81 per cent of the total cost followed by hoeing/weeding 9.47 and 7.63 per cent respectively. Other costlier items followed were harvesting 8.78 and 7.03per cent, threshing 7.86 and 6.85 per cent, preparatory tillage 6.39 and 6.51 per cent, plant protection 5.40 and 4.66 per cent, manures & fertilizers 3.28, and 3.97 per cent, seed 2.93 and 6.74 per cent in moong and gram production, respectively. The B: C ratio in moong and gram were found to be 1.14 and 1.15, respectively. Labour component was utilized efficiently on small farms due to a small area under pulses and thereby resulting in higher productivity and ultimately increase in gross return. Pant & Srivastava (2013) also observed similar results in their study.

Cost and Returns of Moong and Gram on Medium Farms

Items wise cost of cultivation of gram for medium farms has been shown in Table 2. The per acre, gross return from moong and gram on medium farms were estimated ₹15457.95 and ₹15782.60, respectively while the total cost of cultivation of moong and gram on an

Table 1. Cost and returns of moong and gram on small farms in Hisar and Bhiwani district of Haryana 2015-16

(₹/acre)

Inputs	Moong	Percent of total cost	Gram	Percent of total cost
Preparatory tillage	864	6.39	906	6.51
Seed	397	2.93	938	6.74
Sowing	400	2.96	400	2.87
FYM	0	0	0	0
Fertilizer nutrients	443	3.28	553	3.97
Nitrogenous	0	0	0	0
Phosphatic	443	3.28	553	3.97
Potassic	0	0	0	0
Zinc sulfate	0	0	0	0
Irrigation	206	1.52	383.02	2.75
Hoeing/weeding	1281	9.47	1061.89	7.63
Plant Protection	730	5.4	649.06	4.66
Harvesting	1188	8.78	979	7.03
Threshing/winnowing	1064	7.86	953.77	6.85
Miscellaneous	162	1.2	154	1.1
Variable cost (1-12)	6735	49.79	6977	50.12
Interest on working capital @ 9 %	303	2.24	314	2.26
Variable cost	7038	52.03	7291	52.37
Risk factor	704	5.2	729	5.24
Management charges	704	5.2	729	5.24
Transportation	180	1.33	187	1.34
Rental value of land	4900	36.23	4985	35.81
Total cost	13525	100	13921	100
Production (q)	3.474		2.85	
Price per (₹/q)	4266		5332	
Main product	14820		15220	
By-product	521		749	
Gross return	15341		15969	
Return over variable cost	8303		8678	
Net returns	1815		2048	
Cost of production (₹/q)	3894		4877	
B:C Ratio	1.14		1.15	

average was ₹13533.54 and ₹13533.90, respectively per acre. The return over variable cost from moong and gram were ₹8477.35 and ₹8827.72 per acre, respectively. The net returns from moong and gram were ₹1924.41 and ₹2248.70 per acre, respectively. The average production from moong and gram on medium farms were found to be 3.41 and 2.90 quintals per acre and the cost of production per quintal was estimated to ₹3963.66 and ₹4673.02, respectively. The most important cost component in moong and gram were the rental value of land which accounted for 36.78 and 36.94 per cent of total cost followed by harvesting 8.82 and 8.06 per cent respectively. The hoeing/weeding cost in moong and gram were 8.06 and 6.57 per cent, threshing 7.94 and 7.23 per cent, preparatory tillage 6.99 and 7.07 per cent, plant protection 5.91 and 4.61 per cent, and manures and fertilizers 3.12, and 4.05 per cent, seed 3.18 and 6.32 per cent respectively. The B: C ratio in moong and gram were found to be 1.14 and 1.17, respectively. Similar results were observed by Shashikant & Dubey (2013).

Cost and Returns of Moong and Gram on Large Farms

The items-wise cost of cultivation of moong and gram for large farmers of selected districts are shown in Table 3. Per acre gross return from moong and gram on large farms were estimated at ₹15301.32 and ₹15404.31 respectively while the total cost of cultivation was ₹13356.85 and ₹13163.33 respectively. The return over variable cost from moong and gram were ₹8503.95 and ₹8750.35 per acre respectively. The net returns from

Table 2. Cost and returns of moong and gram on medium farms in Hisar and Bhiwani district of Haryana 2015-16

(₹/acre)

Inputs	Moong	Percent of total cost	Gram	Percent of total cost
Preparatory tillage	945.45	6.99	956.52	7.07
Seed	430	3.18	854.96	6.32
Sowing	400	2.96	400	2.96
FYM	0	0	0	0
Fertilizer nutrients	422.73	3.12	547.83	4.05
Nitrogenous	0	0	0	0
Phosphatic	422.73	3.12	547.83	4.05
Potassic	0	0	0	0
Zinc sulfate	0	0	0	0
Irrigation	177.27	1.31	160.87	1.19
Hoeing/weeding	1090.91	8.06	889.13	6.57
Plant protection	800	5.91	623.91	4.61
Harvesting	1193.64	8.82	1091.3	8.06
Threshing/winnowing	1074.55	7.94	978.7	7.23
Miscellaneous	145.45	1.07	152.17	1.12
Total (1 to 12)	6680	49.36	6655.39	49.18
Interest on working Capital @ 9 %	300.6	2.22	299.49	2.21
Variable cost	6980.6	51.58	6954.88	51.39
Risk factor	698.06	5.16	695.49	5.14
Management charges	698.06	5.16	695.49	5.14
Transportation	179.55	1.33	188.04	1.39
Rental value of land	4977.27	36.78	5000	36.94
Total cost	13533.54	100	13533.9	100
Production (q)	3.41		2.9	
Price (₹/q)	4377.27		5186.96	
Main product	14945.78		15022.36	
By-product	512.16		760.25	
Gross return	15457.95		15782.6	
Return over variable cost	8477.35		8827.72	
Net returns	1924.41		2248.7	
Cost of production (₹/q)	3963.66		4673.02	
B:C Ratio	1.14		1.17	

moong and gram were ₹1944.47 and ₹2240.98 per acre respectively. The average production from moong and gram on large farms were found to be 3.34 and 2.74 quintals per acre and the cost of production per quintal was estimated to ₹3995.07 and ₹4796.01, respectively. The most important cost component in moong and gram were the rental value of land which accounted for 37.58 and 38.09 per cent of total cost followed by harvesting 9.01 and 7.98 per cent respectively. The hoeing/weeding cost in moong and gram were 7.76and 5.86 per cent, threshing 8.29 and 7.11 per cent, preparatory tillage 6.39 and 6.95 per cent, plant protection 5.35 and 4.48 per cent, manures & fertilizers 3.14 and 3.91 per cent, seed 3.16 and 6.94 per cent respectively. The B: C ratio in moong and gram were found to be 1.15 and 1.17, respectively. The cost of cultivation was observed to be quite less which was due to the effective resource use efficiency and adequate storage facilities on large farms, resulting in higher marketing prices and ultimately increase in net returns. Singh *et al.* (2010) studied the economics of chickpea production in rain-fed gram in Rajasthan and found similar results.

Overall cost and returns of moong and gram

The items-wise cost of cultivation and returns per acre on the gram for overall farms are presented in Table 4. The total cost of cultivation from moong and gram for overall farms were ₹13499.44 and ₹13700.25 respectively. The net returns were ₹1866.48, and ₹2131.16 per acre in the case of moong and gram. The average production from moong and gram on overall farms were found to be 3.44 and 2.85 quintals per acre and the cost of production per quintal was estimated to be ₹3927.23 and ₹4813.34, respectively. The most important cost component in moong and gram were the rental value

Table 3. Cost and returns of moong and gram on large farms in Hisar and Bhiwani district of Haryana 2015-16

(₹/acre)

Inputs	Moong	Percent of total cost	Gram	Percent of total cost
Preparatory tillage	853.33	6.39	914.29	6.95
Seed	422.67	3.16	913.14	6.94
Sowing	400	2.99	400	3.04
FYM	0	0	0	0
Fertilizer nutrients	420	3.14	514.29	3.91
Nitrogenous	0	0	0	0
Phosphatic	420	3.14	514.29	3.91
Potassic	0	0	0	0
Zinc sulfate	0	0	0	0
Irrigation	180	1.35	114.29	0.87
Hoeing/weeding	1036.67	7.76	771.43	5.86
Plant protection	714.67	5.35	589.29	4.48
Harvesting	1204	9.01	1050	7.98
Threshing/winnowing	1106.67	8.29	936.43	7.11
Miscellaneous	166.67	1.25	164.29	1.25
Total (1 to 12)	6504.67	48.7	6367.43	48.37
Interest on working capital @ 9%	292.71	2.19	286.53	2.18
Variable cost	6797.38	50.89	6653.96	50.55
Risk factor	679.74	5.09	665.4	5.06
Management charges	679.74	5.09	665.4	5.06
Transportation	180	1.35	164.29	1.25
Rental value of land	5020	37.58	5014.29	38.09
Total cost	13356.85	100	13163.33	100
Production (q)	3.34		2.74	
Price (₹/q)	4426.67		5350	
Main Product	14799.82		14683.84	
By Product	501.5		720.47	
Gross return	15301.32		15404.31	
Return over variable cost	8503.95		8750.35	
Net returns	1944.47		2240.98	
Cost of production (₹/q)	3995.07		4796.01	
B:C Ratio	1.15		1.17	

Table 4. Overall cost and returns of moong and gram in Hisar and Bhiwani district of Haryana 2015-16

(₹/acre)

Inputs	Moong	Percent of total cost	Gram	Percent of total cost
Preparatory tillage	882.22	6.53	919.53	6.71
Seed	409.17	3.03	913.42	6.67
Sowing	400	2.96	400	2.92
FYM	0	0	0	0
Fertilizer nutrients	434.44	3.22	545.18	3.98
Nitrogenous	0	0	0	0
Phosphatic	434.44	3.22	545.18	3.98
Potassic	0	0	0	0
Zinc sulfate	0	0	0	0
Irrigation	194.44	1.44	283.93	2.07
Hoeing/weeding	1193.89	8.84	907.58	7.09
Plant protection	744.67	5.52	632.95	4.62
Harvesting	1191.89	8.83	1067.1	7.43
Threshing/winnowing	1073.44	7.95	971.97	6.99
Miscellaneous	158.89	1.18	155.13	1.13
Total (1 to 12)	6683.06	49.5	6796.8	49.61
Interest on working capital @ 9%	300.74	2.23	305.86	2.23
Variable cost	6983.79	51.73	7102.66	51.84
Risk factor	698.38	5.17	710.27	5.18
Management charges	698.38	5.17	710.27	5.18
Transportation	180	1.33	183.57	1.34
Rental value of land	4938.89	36.58	4993.49	36.45
Total cost	13499.44	100	13700.25	100
Production (q)	3.44		2.85	
Price (₹/q)	4320.22		5299.59	
Main product	14850.31		15084.25	
By-product	515.61		747.16	
Gross return	15365.92		15831.41	
Return over variable cost	8382.13		8728.75	
Net returns	1866.48		2131.16	
Cost of production (R₹/q)	3927.23		4813.34	
B:C Ratio	1.14		1.16	

of land which accounted for 36.58 and 36.45 per cent of total cost followed by hoeing/weeding 8.84 and 7.09 per cent respectively. Some other major cost items in operations of moong and gram were harvesting 8.83 and 7.43 per cent, threshing 7.95 and 6.99 per cent, preparatory tillage 6.53 and 6.71 per cent, plant protection 5.52 and 4.62 per cent, manures and fertilizers 3.22 , and 3.98 per cent, seed 3.03 and 6.67 per cent, respectively. The cost of the seed of moong and gram was 3.03 and 6.67 per cent of the total cost and ₹882.22 and ₹919.53 per acre respectively, in real terms. The B: C ratio in moong and gram were found to be 1.14 and 1.16, respectively. Similar results were observed by Pawar & Pawar (2007).

CONCLUSIONS

The cost and returns of moong under different categories of farm revealed that the total cost of cultivation was lowest on large farms (₹13356.85) and followed by small (₹13525) and medium farms (₹13533.54). Less cost of cultivation on large farms may be due to efficient use of available resources i.e. machine power, manures, fertilizers, plant protection etc. by large farmers as compared to medium and small category farmers. The productivity of moong was highest on small farms (3.47q/acre), which was followed by medium (3.41 q/acre) and large farms (3.34 q/acre). The reason for a little higher productivity on a small farm was observed due to better care and management of crop on account of a small area under it. The net returns per acre were highest on large farms (₹1944.47) followed by medium (₹1924.41) and small farms (₹1815). Whereas in case of Chickpea, cost of cultivation per acre of small, medium, large and overall farms were ₹13921, ₹13533.90, and ₹13163.33 and ₹13700.25 respectively. The total cost of cultivation was lowest on large farms and followed by small and medium farm. Gross returns from chickpea for

of small, medium and large were worked out to ₹15969, ₹15782.6, and ₹15404.31 per acre respectively. Among different categories of farmers, large farmers showed highest net returns per acre (₹2241) followed by medium (₹2249)and small categories (₹2048), respectively. Overall net returns on respondent farms were ₹2131 per acre. Small and medium-sized farmer got lower net returns as compared to large farmers. It is due to high retention capacity of large farmers while other categories i.e. small and medium farmers are having a higher proportion of distress sale which leads to decreased bargaining power as well as the lower price received. The area of pulses showing declining trend over the years in the state and pulses are very important food for human and feed for live stocks, therefore, the government should ensure remunerative prices and procurement of pulses so that area and production of pulses could increase to meet-out domestic demand of pulses in the state.

REFERENCES

Department of Economic and Statistical Analysis. (2016). *Statistical abstracts of Haryana, 2015-16*. Retrieved from http://esaharyana.gov.in/en-us/About-Us/State-Statistical-Abstract-of-Haryana/State-Statistical-Abstract-of-Haryana-2015-16

Directorate of Economics and Statistics. (2015). *Agricultural statistics at a glance, 2015*. Directorate of Economics and Statistics, Ministry of Agriculture & Farmers Welfare Government of India, New Delhi. Retrieved from http://eands.dacnet.nic.in/PDF/Agricultural_Statistics_At_Glance-2015.pdf

Pant, M., & Srivastava, S.K. (2013). Profitability of traditional pulse crop cultivation-A study of horse gram (*Macrotyloma uniflorum* Lam.) in the Kumaun hills of Uttarakhand. *Journal of Hill Agriculture, 4*(2), 98-102.

Pawar, B.R., & Pawar, D.B. (2007). The technique of evaluation in the economics of rainfedblackgram and greengram production. *International Journal of Agricultural Sciences, 3*(1), 21-24.

Shashikant, V.G., & Dubey, L.R. (2013). An economic analysis of red gram cultivation in Karnataka. *Indian Journal of Economics and Development, 9*(4), 385-389.

Singh, R., Bishnoi, D.K., & Godara, A.S. (2010). Economics of the rain-fed gram (*Cicer arietinum* L.) in Rajasthan. *Legume Research, 33*(1), 58-60.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 127-132
DOI: 10.5958/2322-0430.2018.00046.X

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Problems of Summer Mungbean Cultivation in Punjab[#]

Gurvinder Singh[1] and Manmeet Kaur[2]*

[1]Ph.D. Scholar and [2]Assistant Professor, Department of Extension Education
Punjab Agricultural University, Ludhiana-141004

[*]Corresponding author's email: gurviaulakh21@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-106* *Revision Accepted: March 08, 2018*

ABSTRACT

***M**ungbean (Green gram) is an important pulse crop that is under cultivation since prehistoric time in India. The short duration pulses like summer mungbean offer a most valuable option for crop diversification which is the need of the hour but production of major pulses is constrained by several biotic and abiotic stresses. This study was conducted in the Punjab state to examine the problems of summer mungbean cultivation. Seventy farmers were selected from five clusters on the basis of the highest concentration of mungbean growing area. The findings revealed that amongst the five different problem areas of summer mungbean cultivation, production-related problems ranked first followed by storage problems, problems related to marketing, value addition and processing, problems related to capacity building and economic and managerial problems for summer mungbean cultivation. The study further pointed out that uncertainty in weather, difficulty in labour management, lack of knowledge about machinery for value addition and packaging, non-availability of market information, and lack of advance payment for stored produce were some of the major problems faced by the summer mungbean growers of Punjab. Emphasis needs to be given by the government on capacity building of the farmers, availability of relevant machinery and establishment of small-scale enterprises on value addition of summer mungbean.*

Keywords
Marketing, problems, processing, summer mungbean, value addition.

JEL Codes
O13, Q10, Q16.

INTRODUCTION

The mungbean *Vigna radiata* (L.) Wilczek has been grown in India since ancient times. It is still widely grown in south-east Asia, Africa, South America and Australia. Mung beans are grown widely for use as a human food (as dry beans or fresh sprouts) but can be used as a green manure crop and as forage for livestock (Oplinger *et al*., 1990). Historically India is the largest producer (25 percent of world's pulses production), consumer and importer of pulses (FAO, 2010). The top five states are Madhya Pradesh, Maharashtra, Uttar Pradesh, Rajasthan and Andhra Pradesh, account for over 75 percent of total production. Madhya Pradesh is the highest pulse-producing state (3.2 million tonnes/annum) followed by Maharashtra and Uttar Pradesh. In terms of productivity, Haryana has the highest yield of 824 kg/ ha followed by Madhya Pradesh, Uttar Pradesh and Bihar (Gowda *et al*., 2013).

In spite of being the world's largest pulse producer, India has been importing 3-4 million tons (MT) of pulses every year to meet its domestic demand (Reddy *et al*., 2012). During the last decade, growth in pulses production has increased significantly. India has achieved a record output in pulses production of 18.1 MT in 2010-11. Even though pulses production increased significantly during the last decade, continuing the faster growth is a bigger challenge for researchers, extension agencies and policymakers. Still, the productivity of pulses in India *i.e.* 694 kg/ha is lower than most of the major pulses producing countries (Reddy, 2009).

The short duration pulses like summer mungbean offer a most valuable option for crop diversification which is the need of the hour. According to a rough estimate area under summer, mungbean is about 50,000 ha in Punjab

[#]***This work is being published from Masters' Research of the first author.***

(Additional Director of Communication, 2012). Punjab requires about 5 lakh tones pulses per annum but total production of pulses is around 80 thousand tonnes in the state. Thus, according to the need of the state, there is a great scope to increase the area and productivity of pulses, particularly in the summer season. During summer, a large area remains fallow after the harvesting of wheat and before the transplantation of rice. Mungbean being a less input, short duration, high-value cash crop fits very well in the rice-wheat cropping system of the state and tremendous potential exists for its expansion. There is a window of 65 to 70 days for growing a crop after wheat and before the main rice crop plantation in June-July (Additional Director of Communication, 2010).

There is a considerable scope for bringing additional area under mungbean but the problems faced by the farmers discourage its cultivation among them. Keeping the above facts in view, the present investigation was planned with the objectives to identify the problems of summer mungbean cultivation and try to explore the solution to these problems.

METHODOLOGY

The present study was conducted in Punjab in 2013 where a stratified multistage random sampling design was followed to select the study area and respondents. At the first stage on the basis of the highest concentrate of mungbean growing areas in Punjab, five clusters were selected, namely Ludhiana, Sangrur, Ferozepur, Moga, and Amritsar. At the second stage, two villages from each cluster were selected based on the highest concentration of summer mungbean cultivation. From each village, a complete list of the summer mungbean growing farmers was taken along with the information about their size of landholding. A sample of seven farmers was randomly selected from each selected village on the basis of probability proportional to the number of farmers in each landholding category. In this way, a total of seventy farmers were selected from ten villages in the five selected clusters for this study.

RESULTS AND DISCUSSION

Problems Faced by the Farmers in Summer Mungbean Cultivation

The information regarding the problems faced by the farmers was studied in five areas *viz.* production-related problems, economics, and managerial problems, problems related to capacity building, problems related to marketing, value addition and processing and storage problems. The information so collected has been discussed in Table 1.

Production-related problems as perceived by the farmers

Six important production related problems were identified and ranked which acted as a barrier to the production of summer mungbean cultivation. The data presented in Table 1 indicate that uncertainty of weather was ranked as the first problem with a mean score of 3.00 followed by the scarcity of labour with a mean score of 2.70 at second rank. The other production problems perceived by the summer mungbean growers in descending order of importance were non-availability of electricity for irrigation, costly seed, and non-availability of the latest and recommended varieties with the mean scores 2.67, 2.18 and 1.98 respectively. The least important production problem perceived by the farmers was the non-availability of machinery for summer mungbean cultivation with a mean score of 1.74. It was observed that if monsoons are late then farmers face drought conditions and if the monsoons are early and heavy then mungbean plants get extra vegetative growth leading to less flowering and fruiting in summer mungbean crop. If monsoons are late then it also coincides with the harvesting period of summer mungbean which makes it difficult for farmers to harvest and thresh the crop. It also deteriorates the quality of mungbean produce as a result of increased moisture content and the problem of spotting. Non-availability of

Table 1. Distribution of farmers according to the production related problems

(N=70)

Production-related problems	D	N	A	MS	Rank
Non-availability of latest and recommended varieties	32 (45.71)	7 (10.00)	31 (44.28)	1.985	V
Costly seed	20 (28.57)	17 (24.28)	33 (47.14)	2.185	IV
Uncertainty in weather	-	-	70 (100.00)	3.000	I
Scarcity of labour	5 (7.14)	11 (15.71)	54 (77.14)	2.700	II
Non-availability of machinery	41 (58.57)	6 (8.57)	23 (32.85)	1.742	VI
Non-availability of electricity for irrigation	7 (10.00)	9 (12.85)	54 (77.14)	2.671	III

Multiple responses; D: Disagree; N: Neutral; A: Agree; MS: Mean Score.
Figures in parentheses are percent of the total.

machinery was not a much problem among the farmers as the medium and large farmers had the required machinery while the marginal and small farmers had less requirement of the machinery because they cultivate summer mungbean on a small scale which is manageable without machinery. These findings are in line with the findings of Grover *et al*. (2005); Gupta & Athavale (2001).

Economic and managerial problems as perceived by the farmers

A perusal of Table 2 indicated the various economic and managerial problems as perceived by the summer mungbean growers. It was evident that the difficulty in labour management ranked first with a mean score 2.54 followed by lack of skill in insect pest and disease management with a mean score of 2.14 at second rank. The other economic and managerial problems perceived by the summer mungbean growers in descending order of importance were lack of financial resources to meet physical inputs and labour cost, lack of subsidies and difficulty in weed management with the mean score of 1.97, 1.84 and 1.74 respectively. It was found that the labour required for this crop is quite high. Majority of the farmers need labour for sowing, weed management, fertilizer applications, plant protection chemicals applications, harvesting, threshing and value addition of summer mungbean crop. Then the labour expenses of farmers increase and it becomes difficult to manage labour. These findings are in line with the findings of Josan (2002); Kaur *et al.* (1989).

Problems related to capacity building as perceived by the farmers

Table 3 elicits the four problems related to capacity building faced by the summer mungbean growers. The data revealed that lack of knowledge about machinery for value addition and packaging ranked first with a mean score of 2.52 followed by lack of knowledge about marketing, value addition and processing with a mean score of 2.34, lack of relevant literature at rank third with a mean score of 2.15 and inadequate knowledge about mungbean cultivation in summer season with a mean score of 1.52 at the last rank. It was concluded that

Table 2. Distribution of farmers according to the economic and managerial problems

(N=70)

Economic and managerial problems	D	N	A	MS	Rank
Lack of financial resources to meet physical inputs and labour cost	29 (41.43)	14 (20.00)	27 (38.57)	1.971	III
Lack of subsidies	25 (35.71)	31 (44.29)	14 (20.00)	1.842	IV
Difficulty in labour management	16 (22.86)	-	54 (77.14)	2.542	I
Difficulty in weed management	42 (60.00)	4 (5.71)	24 (34.29)	1.742	V
Lack of skill in insect pest and disease management	21 (30.00)	18 (25.71)	31 (44.29)	2.142	II

***Multiple responses.**
D: Disagree; N: Neutral; A: Agree; MS: Mean Score.
Figures in parentheses are percent of the total.

Table 3. Distribution of farmers according to the problems in the area of capacity building

(N=70)

Capacity building problems	D	N	A	MS	Rank
Inadequate knowledge about mungbean cultivation in summer season	47 (67.14)	9 (12.86)	14 (20.00)	1.528	IV
Lack of relevant literature	23 (32.86)	13 (18.57)	34 (48.57)	2.157	III
Lack of knowledge about marketing, value addition, and processing	19 (27.14)	8 (11.43)	43 (61.43)	2.342	II
Lack of knowledge about machinery for value addition and packaging	10 (14.29)	13 (18.57)	47 (67.14)	2.528	I

***Multiple responses.**
D: Disagree; N: Neutral; A: Agree; MS: Mean Score.
Figures in parentheses are percent of the total.

majority of sample farmers were focusing on the production of summer mungbean rather than its storage, value addition, and marketing. This was the main reason that farmers lacked knowledge about machinery for value addition and packaging while they were having good knowledge regarding the production system of this crop. These findings are in line with the findings of Kaur *et al.* (1989).

Problems related to marketing, value addition, and processing as perceived by the farmers

Problems were faced by the farmers under the category of marketing, value addition, and processing which are presented in Table 4. It was observed that non-availability of market information was at first rank with a mean score of 2.57 followed by the seasonal glut in the market at second rank with a mean score of 2.54. The rank order revealed that delayed payment of produce was considered least important in this category with a mean score of 1.57. The other constraints perceived by the summer mungbean growers were fluctuation in market rates of produce at rank three, the inappropriate rate of the value-added products at rank four and lack of skilled labour for value addition and processing at rank five with mean scores of 2.45, 2.04 and 1.91 respectively. It was observed that there was a lot of fluctuations in the production, supply and market rate of summer mungbean produce because of its low minimum support price. Then it is difficult for farmers to have latest and accurate market information regarding this crop. It was also found that farmers are not aware regarding the source from where knowledge about the market information can be obtained. Lack of skilled labour for value addition and processing was placed at last rank because the majority of the sample farmers were not involved in the value addition forms of summer mungbean which required skillful labour. These findings are in line with the findings of Bhatia (1991).

Storage problems as perceived by the farmers

Data presented in Table 5 depicts that out of all the four problems related to storage, lack of advance payment for stored produce was ranked first with a mean score of

Table 4. Distribution of farmers according to the problems in area of marketing, value addition, and processing

(N=70)

Marketing, value addition and processing related problems	D	N	A	MS	Rank
Lack of skilled labour for value addition and processing	30 (42.86)	16 (22.86)	24 (34.28)	1.914	V
Inappropriate rate of the value-added products	12 (17.14)	43 (61.43)	15 (21.43)	2.042	IV
Non-availability of market information	15 (21.43)	-	55 (78.57)	2.571	I
Fluctuating market rates of produce	16 (22.86)	6 (8.57)	48 (68.57)	2.457	III
Delayed payment of produce	46 (65.71)	8 (11.43)	16 (22.86)	1.571	VI
Seasonal glut in the market	10 (14.29)	12 (17.14)	48 (68.57)	2.542	II

***Multiple responses.**
***D: Disagree; N: Neutral; A: Agree; MS: Mean Score.**
Figures in parentheses are percent of the total.

Table 5. Distribution of farmers according to the problems in the area of storage

(N=70)

Storage problems	D	N	A	MS	Rank
Lack of storage infrastructure	18 (25.72)	5 (7.14)	47 (67.14)	2.414	II
Difficulty in storage pest management	29 (41.43)	9 (12.86)	32 (45.71)	2.042	III
Deterioration in the quality of produce due to rain	29 (41.43)	15 (21.43)	26 (37.14)	1.957	IV
Lack of advance payment for stored produce	2 (2.86)	7 (10.00)	61 (87.14)	2.842	I

***Multiple responses.**
***D: Disagree; N: Neutral; A: Agree; MS: Mean Score.**
Figures in parentheses are percent of the total.

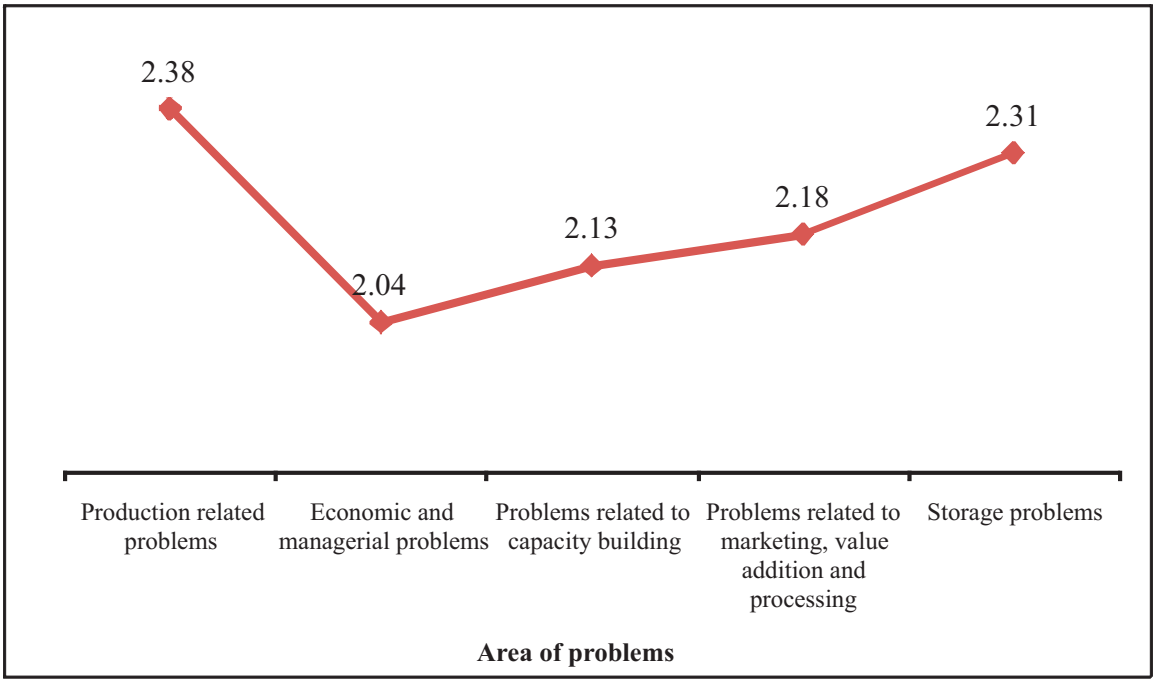


Figure. 1. Problem areas according to the average means score of farmers

2.84 followed by lack of storage infrastructure with a mean score of 2.41 at rank second. The other perceived problems in order of importance were difficulty in storage pest management and deterioration in the quality of produce due to rain with mean scores of 2.04 and 1.95 mean scores, respectively. It was found that most of the farmers had medium operational land holding and were not much economically sound. They needed immediate payment of their products to fulfill their domestic requirements. In case of mungbean, such facilities were not available which can provide them advance payment for their stored produce.

Ranking of Different Problem Areas on the Basis of Average Mean Score of the Farmers

The five areas under which the problems of the farmers regarding summer mungbean cultivation were studied have been ranked and presented in Table 6. The data indicated that the production related problems ranked first with the highest average mean score of 2.38 followed by storage problems with an average mean score of 2.31 at second rank. The problems related to marketing, value addition and processing were at rank three with an average mean score of 2.18 while problems related to the capacity building were at rank four with an average mean score 2.13. The least important area of problems was the economic and managerial problems for summer mungbean cultivation with an average mean score of 2.04.

Production-related problems got the first rank as the majority of summer mungbean growers faced high constraints like uncertainty in weather, scarcity of labour, non-availability of electricity for irrigation, *etc.* In the case of storage of summer mungbean produce, most of the farmers were willing to store their produce so as to sell it at an appropriate time but due to lack of advance payment and storage infrastructure, they were unable to do so.

Table 6. Ranking of different problem areas in summer mungbean cultivation on the basis of average means score of farmers

Area of problems	Average mean score	Ranks
Production-related problems	2.38	I
Economic and managerial problems	2.04	V
Problems related to capacity building	2.13	IV
Problems related to marketing, value addition, and processing	2.18	III
Storage problems	2.31	II

CONCLUSION AND SUGGESTIONS

It was concluded from the study that amongst the five different problem areas of summer mungbean cultivation, production-related problems ranked first followed by storage problems, problems related to marketing, value addition and processing, problems related to capacity building and economic and managerial problems for summer mungbean cultivation. Thesuggestions to promote summer mungbean cultivation among Punjab farmers have been suggested on the basis of the

observations made during the study as well as suggested by the farmers.

1. Uncertainty in weather conditions such as rainfall near harvesting results in shattering of pods. Researchers should focus on the generation of varieties which can withstand heavy rains and uncertain weathers.
2. Labour shortage during harvesting of mungbean is a major problem as most of the labour is engaged in paddy transplantation. Besides, labour is very expensive. So machinery for harvesting and threshing of mungbean should be made available at the village level through co-operative societies.
3. The government should encourage the farmers for summer mungbean cultivation by providing sufficient electricity for irrigation purpose.
4. Emphasis needs to be given on capacity building of the farmers in terms of availability of finance, insect-pest and disease management, marketing, storage, value addition, and processing of summer mungbean by PAU. State Department of Agriculture can play a significant role to upgrade the knowledge and skill of farmers with respect to summer mungbean through their training camps.
5. Establishment of small-scale enterprises for grass root level value addition and processing of summer mungbean.
6. Machinery for value addition should be subsidized so as to encourage the farmers for value addition and processing at grass root level. Also, these machines can be provided to the cooperative societies to facilitate their custom hiring by the farmers.
7. The government should lay emphasis on the development of infrastructure for storage, marketing, value addition and processing of summer mungbean.
8. Farmers should be motivated through different media to adopt the cultivation of summer mungbean. Sufficient literature in local language should be made available to the farmers in time. Case studies and success stories of summer mungbean growers should be highlighted to encourage other farmers to adopt this crop.

REFERENCES

Additional Director of Communication. (2010). *Package of practices for crops in Punjab: Kharif crops.* Punjab Agricultural University, Ludhiana.

Additional Director of Communication. (2012). *Package of practices for crops in Punjab: Kharif crops*. Punjab Agricultural University, Ludhiana.

Bhatia, M.S. (1991). Economic constraints in increasing pulse production. *Agricultural Situation in India 46*, 279-284.

FAO (2010). Retrieved from http://faostat.fao.org..

Gowda, C.L.L., Srinivasan, S., Gaur, P.M., & Saxena, K.B. (2013). Enhancing the productivity and production of pulses in India. In P.K.Shetty, S. Ayyappan and M .S. Swaminathan (Eds.) *Climate Change and Sustainable Food Security*, Pp 63-76. National Institute of Advanced Studies, Bangalore and Indian Council of Agricultural Research, New Delhi.

Grover, D.K., Weinberger, K., Shanmugasundaram, S., & Singh, G. (2005) Constraint analysis of mungbean production in cereal-based cropping system in Punjab. *Journal of Research, 42,* 223-231.

Gupta, S.K., & Athavale, M.C. (2001). Pulses production: Constraints and strategies-A state-wise analysis. *Agricultural Situation in India, 59,* 685-592.

Josan, K.P.S. (2002) *Pea cultivation in Nizampur village of Amritsar district in Punjab* (Master's Thesis).Punjab Agricultural University, Ludhiana, Punjab, India.

Kaur, M., Kaur, D., & Kaur, S. (1989). Opinion of Punjab Kisan Club members towards diversification of agriculture. Paper presented at *North-western Regional Seminar on Extension Strategy for Diversification of Agriculture* (pp. 26-28). Punjab Agricultural University, Ludhiana, India.

Oplinger, E.S., Hardman, L.L., Kaminski, A.R., Combs, S.M., & Doll, J.D. (1990). *Mungbean: Field crop manual*. The University of Wisconsin-Extension, Cooperative Extension University of Minnesota: Center for Alternative Plant and Animal Products and the Minnesota Extension Services.

Reddy, A.A. (2009). Pulses production technology: Status and way forward. *Economic and Political Weekly, 64,* 73-80.

Reddy, A.A., Bantilan, M.C.S., & Mohan, G. (2012). *Enabling pulses revolution in India. I*nternational Crops Research Institute for the Semi-Arid Tropics, Patancheru, Andhra Pradesh, India.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 133-137
DOI: 10.5958/2322-0430.2018.00047.1

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Preferences for Technological Attributes of Pigeonpea Farmers in Saurashtra Region (Gujarat): A Conjoint Analysis

Shah Parth, N.J. Ardeshna, Daya Suvagiya and B. Swaminathan*

Department of Agricultural Economics, Junagadh Agricultural University,Gujarat-362001

**Corresponding author's email: parthrrr123@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-110* *Revision Accepted: March 01, 2018*

ABSTRACT

Agricultural sector has been actively responding to consumer demand in terms of taste, colour, size, shape, content, nutrition value and overall food quality and safety. The present study was conducted to examine farmers' preferences associated with the technological attributes of pigeonpea in Rajkot and Junagadh districts of Saurashtra region (Gujarat). The primary data were collected using snow-ball sampling technique and conjoint analysis was conducted to assess the stakeholders' preferences. The findings revealed that the farmers preferred crop duration as the most important attribute followed by plant height, viral disease and wilt resistance, output price, yield for cultivation of pigeonpea. The study suggests that production related information should be packaged to include consumer preferred varieties and made available to progressive farmers and seed companies who may have a greater outreach to farmer.

Keywords
Attributes, Conjoint Analysis, Pigeon pea, stakeholders.

JEL Codes
C35, C83, C87, Z21.

INTRODUCTION

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is one of the major pulse crops of semi-arid tropics. It finds an important place in the farming system adopted by small holding peasants in a large number of developing countries. The importance of pigeonpea in Indian agriculture can be ascertained from the fact that more than 90 percent of global area of pigeonpea falls in India alone contributing more than 67 percent of the world's production (FAO, 2015). India is the largest producer (25 percent of global production), consumer (27 percent of world consumption) and importer (14 percent) of pulses in the world. Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and Karnataka are the top five pulses producing states. The area, production, and productivity of pigeonpea in India have increased considerably in first decade of 21st century. In India, gram is the most dominant pulse having a share of around 40 percent in the total pulses production, followed by pigeonpea around 15 to 20 percent. India is the largest producer of pigeonpea in the world cultivating about an area of 3.54 million hectares with a production of 2.56 million tonnes during 2015-16. In Gujarat, pigeonpea production was meager till 1970s and increased considerably in 1980s and 1990s, and then it became stagnant in 2000s onwards. In Gujarat, pigeonpea occupied 4.29 lakh ha in 1990-91 which, gradually decreased to around 2.82 lakh ha in 2015-16, but productivity increased from 851 kg/ha to 1228 kg/ha in 1990-91 and 2015-16, respectively (Dhandhalya *et al.,* 2016).

Most of the pigeonpea varieties that are grown in India are first processed and only the *dal* samples enter the market channels for consumer use. Therefore, for pigeonpea utilization, milling and processing characteristics of whole seed, as well as the consumer's preferences are important. As these quality attributes are vital in explaining price variation in the market, answers to these questions will sharpen the focus of pigeonpea improvement by the scientists on quality attributes as demanded by consumer. Although, the agricultural sector

has been actively responding to consumer demand by attempts to produce more food, the failure rate of an increase in food supply still remains high. Apart from its myriad problems in production and distribution, the sector is also being criticized in this regard for not knowing its consumer. To fill this gap, this study examines the farmers' preferences associated with the technological attributes of the ruling varieties of pigeonpea in Gujarat. Knowledge of these attributes and their levels can be used as guide for improving marketing efficiency of pigeonpea and for development of upcoming varieties.

OBJECTIVES AND METHODOLOGY

The main objective of the paper is to identifying and determining technological attributes of existing pigeonpea varieties among farmers in the study area. For the present study, primary data were collected from the pigeonpea farmers on their preference for common technological attributes. The data was analyzed using conjoint analysis. unagadh and Rajkot districts of Gujarat were purposively selected as both the districts seem to have considerable pigeonpea acreage in the state. The data was analyzed using conjoint analysis. Two talukas were selected from each of the selected districts. This was followed by random selection of 15 farmers from each of the selected talukas.

Conjoint Analysis

Conjoint analysis is a market research tool based on preferences which can be used for developing effective products. It is a method that estimates the structure of individual preference given overall evaluation of a set of alternative products with pre-specified levels of various attributes. Using conjoint analysis, one can derive inference on the individual attitude and preference towards a specific product attribute. The design specification includes choosing the attributes with their associated levels (Halbrendt *et al*., 1991). In the present study, conjoint analysis was used to find the relative importance of the attributes preferred by farmers. All the identified technological attributes along with their levels was presented in Table 2. As full concept method is considered a more realistic and economically valid method, since all factors are considered at the same time, thereby, it was used in the present study for data collection.

Preference Combinations

The total number of combinations of attribute levels of pigeonpea for farmers was found to be 162 (3×2×3×3×3). Consequently, as in most conjoint surveys, only a suitable fraction of combinations which captured all possible alternatives are selected. This subset of combinations of attribute levels is generally called the orthogonal array (Belcher *et al*., 2007). This array is generated using the orthogonal array design feature in SPSS's conjoint analysis module (SPSS, 2005). This process would select different product combination scenario out of the total combinations and the selected combinations/ plan cards are presented in Table 1.In order to complete the conjoint analysis portion of the survey, selected respondents were asked to rate their preferences in lieu of the given combinations. Twenty orthogonal plan cards were generated by conjoint procedure for each stakeholder and preference rating was given subsequently. The respondent's choice of pigeonpea (through the cards) was noted down to find out the most preferred characteristics.

Additive Conjoint Model

Following Dhamotharan & Selvaraj (2013), the present study has employed the additive conjoint model as it happens to be the effective and by far the most frequently used model. Further, in this model, the omission of the attribute does not have a major impact on part-worth estimates. The additive model assumes that the overall evaluations are formed by the sum of separate part-worth so utilities of the attribute levels. The model has been formulated as under:

$$Y \quad {}^{J}_{j} \; {}^{M}_{1} \; {}^{}_{k} \; {}^{}_{1} \; {}_{jm} x_{km}$$

Where,

Y= Estimated total utility for alternative;

β_{jm}= Partial utility for rank 'm' of attribute 'j'; and

X_{km}= Dummy variable (1 if attribute 'k' has value 'm',0 otherwise)

RESULTS AND DISCUSSION

Preferred Technological Attributes

Attributes considered having a substantial influence on stakeholder's preferences, and their demand was identified, through pilot survey, expert discussion with prominent pulse scientist and using literature review. All the identified attributes along with their levels was presented in Table 2 for farmers. To assess preference structure for pigeonpea in the study region, attributes identified for farmers are; crop duration, plant height, crop resistance, output price and yield (Table 2).

Pattern of Attributes of Pigeon Pea Determining Farmers Varietal Preferences

Farmer's decision to adopt particular variety of pigeonpea is largely influenced by its attributes like duration, height, resistance, price, yield, *etc*. Hence, an attempt was made to elicit the kind of preference that farmers had towards the varietal characteristics of pigeonpea. Plan cards were administered to sample farmers according to the sampling procedure. The respondents were asked to score the cards. Average partworth's and the relative importance of the attributes are presented in Table 3 and Figure 1. Each attribute has a unique estimate of part worth that indicates the attribute level's contribution to overall utility when contained within a product profile. Higher positive or lower negative partworth's denotes, *ceteris paribus,* a higher perceived utility. For each respondent, the part worth was estimated using OLS regression analysis. The fit of the additive model to the individual data was good. This table

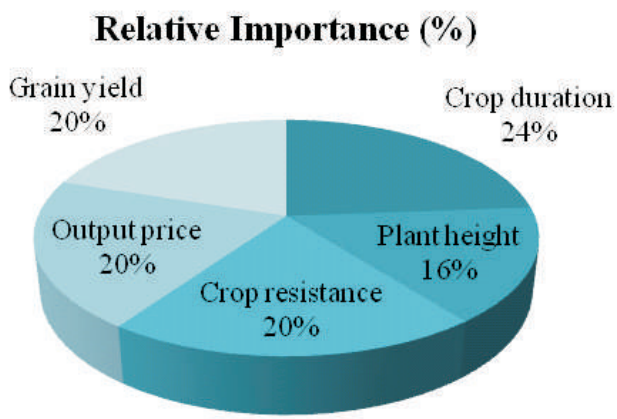


Figure. 1. Relative importance of pigeonpea preference by farmers

displays two statistics, Pearson's R and Kendall's tau, which provide measures of the correlation between the observed and estimated preferences. The table displays Kendall's tau for just the holdout profiles (four in the present example), which were rated by the subjects but not used by the Conjoint procedure for estimating utilities. Instead, the conjoint procedure computes correlations between the observed and predicted rank orders for these profiles as a check on the validity of the utilities. The Pearson's rank correlation test value was 0.837 which was significant statistically; this gives us strong confidence in the suitability of the additive model.

The perusal of Table 3revealed that among all the attributes studied in pigeonpea verities, duration and price were the most important attributes in the adoption of particular variety. Crop duration of particular variety was found to have the greatest influence accounting for 23.80 percent of relative importance, short duration variety ranging from 130 to 150 days were most preferred (utility 2.292) while long duration varieties were least preferred. Plant height has the least important of 15.682 percent. Output price of a particular variety has found to have greater influence on the farmers accounting for 20.325 percent of relative importance, more than ₹7000 were the most preferred (utility 2.013) and remaining two ₹6000-₹7000 and ₹5000-₹6000 were least preferred having the utility of -1.581 and -1.432, respectively. Crop resistance and yield have a strong influence on the farmer accounting for 20.211 and 19.980 percent preferred next to the price. Cultivar resistance to viral diseases and wilt were most preferred with utility of 2.099 and 1.950 and Helicoverpa was found least preferred. Yield was next preferred to resistance having relative importance of 19.980 percent with more than 15 quintal yield having the

Table 2. Preferred technological attributes of pigeonpea farmers and their associated levels

Attributes	Levels
Crop duration (Days)	130-150; 150-170 and >170
Plant height	Medium and Short
Crop Resistance	Helicoverpa; Wilt and Viral diseases
Output price (₹/q)	5000-6000; 6000-7000 and >7000
Grain yield (q/ha)	7-11 ; 11-15 and >15

Table 1. List of orthogonal array of selected alternatives for farmers

Plan card	Crop duration (Days)	Plant height	Pest Resistance	Price (₹/q)	Grain yield (q/ha)
1	150-170	Medium	Wilt	5000-6000	11-15
2	130-170	Medium	Helicoverpa	5000-6000	7-11
3	150-170	Short	Helicoverpa	6000-7000	>15
4	>170	Short	Viral disease	5000-6000	>15
5	130-150	Short	Helicoverpa	5000-6000	11-15
6	130-150	Short	Helicoverpa	5000-6000	7-11
7	150-170	Medium	Viral disease	5000-6000	7-11
8	130-150	Short	Viral disease	>7000	11-15
9	150-170	Short	Helicoverpa	>7000	7-11
10	>170	Short	Wilt	5000-6000	7-11
11	>170	Medium	Helicoverpa	>7000	7-11
12	130-150	Medium	Viral disease	6000-7000	7-11
13	130-150	Short	Wilt	6000-7000	7-11
14	>170	Medium	Helicoverpa	6000-7000	11-15
15	130-150	Medium	Helicoverpa	5000-6000	>15
16	130-150	Medium	Wilt	>7000	>15
17	130-150	Medium	Wilt	5000-6000	>15
18	>170	Short	Helicoverpa	>7000	7-11
19	150-170	Short	Helicoverpa	5000-6000	11-15
20	>170	Medium	Wilt	5000-6000	>15

Table 3. Attributes of pigeonpea most preferred by the farmer

Attributes	Levels	Utility value	Relative importance (Percent)
Crop duration (days)	150-170	-1.200	23.802
	>170	-1.729	
	130-150	2.292	
Plant height	Medium short	-1.465	15.682
		1.465	
Crop resistance	Helicoverpa	-1.092	20.211
	Wilt Viral diseases	1.950	
		2.099	
Output price (₹/q)	6000-7000	-1.581	20.325
	>7000	2.013	
	5000-6000	-1.432	
Grain yield (q/ha)	7-11	-1.134	19.980
	11-15	-0.792	
	>15	1.893	
Pearson's rank correlation		0.837***	
Kendall's tau correlation		0.517***	
Constant		0.521	

***Significant at 1 percent level.*

utility of 1.893, whereas 7-11 and 11-15 quintal yield having utility of -1.134 and -0.792 respectively.

Pigeonpea is the most important pulse crop and important source of protein. It is grown in many states of India under diverse dry or irrigated land conditions. It has high level of regional or local adaptation. Although many improved cultivars have been released, farmer accepted only a few. Thus it became necessary to evaluate the pigeonpea varieties to arrive at the most preferred ideal variety. Duration of the crop was by far the most important attribute to explain the varietal preference and short duration varieties (130-150 days) were most preferred, deriving the utility of 2.292, a long duration rainfed crop of 170-180 days suffered serious shortage of moisture in end of season lead to formation of immature seeds and unfilled (shrivelled) seeds leading to formation of green *dal* which fetched low prices in the market. Farmer preferred the short duration varieties to achieve good yield with even minimum shower Desirable traits and varietal preferences for short and medium duration pigeonpea were site-specific as a reflection of local farmer problems need and management abilities. The analysis suggested that with increased commercialization, farmers preferences became more market-oriented, while in a subsistence production system, preferences were more related to cooking and eating quality.

Resistant to viral disease as an attribute was by far as greater importance (20.21 percent), because it affected the crop most. Farmer had given less importance to Helicoverpa because it could be easily managed by pesticide. Price and yield as an attribute bear more importance (40.30 percent), here farmer were of the view that yield of more than 15Q (utility 1.893) and price of more than ₹7000 were preferred. From this, we can say that farmer preferred the variety which should give optimum yield and should fetch good price in the market. The results are on par with Rao *et al.* (1991). They also observed that farmers preferred pigeonpea with brown, large seed and round shape. The significant value of Pearson's rank correlation (0.837) at one percent level showing fit of the additive model to the individual data was good.

CONCLUSIONS AND POLICY RECOMMENDATIONS

The stakeholders are becoming more aware of the quality attributes of pigeonpea in the study area and are choosing products that closely match their tests and preferences. The findings of the study suggested that breeder should consider farmers' preference of short duration crop, resistance to pests and disease especially tur pod borer and wilt and higher yield. The study suggests that production related information should be packaged to include consumer preferred varieties and made available to progressive farmers and seed companies who may have a greater outreach to farmer.

REFERENCES

Belcher, K.W., German, A.E., & Schmutz, J.K. (2007). Beef with environmental andquality attributes: Preferences of environmental group and general population consumers in Saskatchewan, Canada. *Agricultural and Human Values, 24*(3), 333-342.

Dhamotharan, P.G., & Selvaraj, K.N. (2013). Determining consumer preference and willingness topay for GI registered Bananas. *Journal of Intellectual Property Rights.18,* 7576-583.

Dhandhalya, M. G., Tarpara, V.D., Shiyani, R.L. & Chavda, H. (2016). *Prospects and trade potential of arhar and gram production in Gujarat*. Research Report. Department of

Agricultural Economics, Junagadh Agricultural University, Gujarat.

FAO. (2015). Retrieved from http://faostate.fao.org/site/339/default.aspx.

Halbrendt, C.K., Wirth, F.F., & Vaughn, G.F. (1991). Conjoint analysis of the mid -Atlantic food-dish market for farm-raised hybrid striped bass. S*outhern Journal of Agriculture Economics, 23*(1), 155-163.

Rao, P.P., Singh, L., Singh. U., & Walker, T.S. (1991). Consumer preferences for pigeonpea grain quality. *Resource Management Program Economics Group Progress Report-102*, 1997. 1991.

SPSS. (2005). *Statistical package for social sciences*, SPSS Conjoint™ 14.0 User Guide/Manual.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 138-142
DOI: 10.5958/2322-0430.2018.00048.3

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Effect of Liberalization on Growth and Instability in Area Production and Yield of Major pulses in Maharashtra

K.P. Bhagwat, V.D. Waiwal, A.V. Gavali and D.B. Yadav*

Department of Agricultural Economics, Mahatma Phule Krishi Vidyapeeth, Rahuri District Ahmednagar

Corresponding author's email: vijay.waiwal@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-119* *Revision Accepted: March 10, 2018*

ABSTRACT

Growth in agricultural production along with low instability is highly desirable. The objective of this study was to investigate effect of liberalization on growth and instability in area production and yield of major pulse crops in Maharashtra. The finding of the study revealed positive and encouraging trends for arhar and gram among the pulses for area and production. The yield trends for all pulses were positive and significant. In Maharashtra, the area, production, and productivity of major pulse crops indicated that relatively lower instability in Post-WTO period than Pre-WTO period. The instability indices were higher for production due to area instability.

Keywords

Area, Cuddy-Della Valle index, growth, instability, major pulses, production, yield.

JEL Codes

F13, F68, O44, P32, Q18.

INTRODUCTION

Agriculture growth with stability has been a matter of great concern. In order to provide food for increasing population, the stable agricultural growth needs to be achieved over the period and among the different regions. The Maharashtra state comprised Konkan, Western Maharashtra, Marathwada and Vidarbha regions. Gross cropped area of the State increased from 188.23 to 231.16 lakh hectares during last fifty-six years. The crop production in the State is mainly dependent on weather conditions, availability of inputs, nature of production technology and economic environment. The important pulses growing in the state are arhar, mung, udid, and gram. The total area under major pulses was increased from 23.22 lakh ha to 35.43 lakh ha. With increased production of 8.58 lakh tonnes to 14.32 lakh tones in 1960-61 to 2015-2016, but the growth in area and production largely varies from crop to crop and region to region of the state indicating instability in production in the state.

It is generally argued that instability in agriculture production has increased due to technological progress in agriculture. However, studies proved that instability in agriculture production has decreased due to expansion of modern technology. Dhillon & Ali (2002) examined the productivity growth in the agricultural sector of Punjab. They revealed that the introduction of package of green revolution and its wide adoption changed the agricultural scenario of Punjab. Sharma & Prakash (2002) studied the production and productivity of major pulses in the country for the period 1950-51 to 1999-2000. They concluded that there was a slow as well as low growth in area of pulses and the production of pulses has not attained stability so far. Pal (1986) found that variability in foodgrains production increased with the adoption of modern technology. On the other hand, Singh & Byerlee (1990) concluded that wheat yield variability decreased with the expansion of modern technology across country. Kumar *et al.* (2013) have analyzed the growth and instability in groundnut crop in India during technology oilseed mission (TOM) and in liberalization policy era. The empirical results show that the ACGR of groundnut were increased during TOM. But, the ACGR have decreased in post WTO period. The compound growth

rates in area, production, and productivity of cotton in India. They have considered the period before and after the establishment of WTO and the results are evidence that there is significant growth in area, production, and productivity during the post-WTO than the pre-WTO. The main objective of the paper is to examine the growth and instability in area production and yield of major pulse in Maharashtra.

METHODOLOGY

This study is based on time series data related to area, production and productivity of major selected pulse crops namely, arhar, mung, udid, and gram from the year 1975-76 to 2012-13. Data have been collected from the publications of Government/Non-Governmental Organizations such as Epitome, District Statistical Abstracts, Agriculture Statistics ata Glance, etc. The time span is further divided into three periods namely, Period-I: 1975-76 to 1993-94, which is Pre- liberalization period and where agriculture sector was not liberalized, from 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 cereal crops and the overall period: 1975-76 to 2012-13.

Growth rates of area, production and productivity for each cereal crops have been estimated by the following regression;

$Y = ab^t$

Where,

Y = Area, production and productivity of selected crops.

t = Time variable in years

a = Intercept

b = Regression coefficient.

The instability index is estimated by using the Cuddy-Della Valle index(Cuddy-Della Valle index, 1978);

$$CD = (CV^*)(1-R^2)^{1/2}$$

Where, CD is the Cuddy-Della Valle index of instability; CV* is coefficient of variation without trend-adjusted data, and R^2 is coefficient of multiple determination from a time trend regression adjusted by the number of degrees of freedom.

RESULTS AND DISCUSSION

The central Government policy is to reduce the restrictions on the external thread is the main feature associated with liberalization that started in the 1st January 1995. The free tread policy contributed considerable to agricultural growth in the state.

It is revealed from the table that, during Period-I, the growth rate in area under udid declined significantly by 2.20percent in Western Maharashtra region in the state. Among the major crops, the highest significant growth rates in the area of mung15.91 percent in Konkan, gram 4.01 percent in Western Maharashtra, arhar 2.78 percent in Marathwadaandmung6.36 percent in Vidarbha region was noticed. Pre-liberalization, Period-I (1975-76 to 1993-94) was characterized by increase in production of almost all the crops in the all the regions either significantly or non- significantly except, arhar (0.52 percent) in Western Maharashtra region in the state. This happens only due to declined productivity under the crop in the respective region.

Second period, Post-liberalization Period (1994-95 to 2012-13) witnessed increased productivities of major pulse crops except mung in Marathwada, showed negative compound growth rates. Whereas significantly declining area under major pulse crops except, mung in Konkan, arhar, and gram in Marathwada and Vidarbha region showed positive compound growth rates.

During the overall period, growth rates in case of area, production and productivity ofgram increased significantly in the state. Whereas production witnessed increased trend of major pulse crops in all the regions of the state except, arhar in Konkan and Western Maharashtra. It might be due to increased in productivities under these crops.

The growth rates in area, production, and productivity of major pulses increased significantly during Period-I, The growth rates in area, production, and productivity of arhar and gram increased significantly during post-liberalization period indicating the positive effect of liberalization and agricultural developmental schemes. The growth rates in the case of productivities of all the major pulse crops increased significantly with different magnitudes in the state during the same period,

At the overall period, growth rates in case of production of almost all the crops increased significantly. It is clearly indicated that the production of these crops were increased by both area expansion and productivity improvement in the state. Whereas growth rates in area, production and productivity of arhar (1.33, 2.43 and 1.08 percent) gram (3.09, 5.72 and 2.56 percent), per annum increased significantly and negative growth rates were observed in case of area under mung (0.39percent), and udid (0.39percent), respectively.

The performance of area dispersion during Period-I indicated that mung stood first (6.59 percent) in least instability in Marathwada, and greatest (66.71percent) instability in Konkan region. The Instability indices in production indicated that arhar stood first in least instability (22.11percent) in Vidarbha region whereas mung exhibited greatest (62.84percent) instability in Konkanregion. The highest instability in production of mung might be due to greater production of mung ver a shorter period and also greater instability in area under mung.

Instability indices regarding productivity of major pulse crops revealed that least instability was observed in arhar (16.49 percent) in Western Maharashtra region while the greater instability in udid in Marathwada region as compared to other regions of the state.

During Period-II, maximum instability was expressed by area under gram (27.25 percent)in Vidarbha

region and arhar occupied first position in least instability among the regions and crops in the state. The increased instability in area under major pulses was observed in the post-liberalization period over pre-liberalization period. Instability in production of arhar and mung in Konkan, arhar in Western Maharashtra, arhar, mung and udid in Marathwada and mung, udid and gram in Vidarbha regions showed highest instability. The instability index for productivity of mungwas36.28percent in Marathwada, which was highest as compared to other crops. Among the crops and regions, the lowest instability was observed in gram (10.10 percent) in Western Maharashtra.

It is revealed from table that, least instability (8.16percent) was observed in case of area under arhar while the maximum instability in case of arhar (88.31 percent) during the overall period 1975-2013. It might be due to greater area under crop over a shorter period.

Table 1. Region-wise compound growth rates of area, production,and productivity of major pulses in Maharashtra (Period-I 1975-76 to 1993-94)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Arhar	14.85 ***	15.09 ***	0.21	0.05	-0.52	-0.56	2.78 ***	1.77	-0.98	4.82 ***	4.99 ***	0.16
Mung	15.91 ***	13.46 ***	-2.11	1.11 **	3.22 **	2.08 **	0.16	1.96	1.80	6.36 ***	13.2 ***	6.44 ***
Udid	1.12	7.53 ***	6.33 ***	-2.2 ***	-0.24	2.01	0.04	3.83	3.78	2.73 ***	7.71 ***	4.84 ***
Gram	7.21 ***	10.24 ***	2.82 ***	4.01 ***	7.17 ***	3.04 ***	-0.11	2.43 *	2.54	4.20 ***	8.55 ***	4.17 ***

, ** and *** Significant at 10, 5 and 1 percent level.

Table 2. Region-wise compound growth rates of area, production,and productivity of major pulsesin Maharashtra (Period-II 1994-95to 2012-13)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Arhar	0.06	1.24	1.19	-4.1 ***	-2.47 *	1.73 **	0.97 ***	6.22 ***	4.01 *	0.57 **	0.27	-0.29
Mung	3.36 **	2.46	-0.87	-1.34 **	-2.01 *	-0.35	-3.67 ***	-1.27	1.71	-4.48 ***	-5.37 **	-1.01
Udid	-0.90 *	-0.71	0.17	-1.34 **	-1.12	0.23	-2.06 **	-2.22	0.08	-6.28 ***	-6.32 ***	0.09
Gram	-0.43	1.64 **	2.08 ***	0.59	2.32 **	1.72 ***	3.65 ***	6.85 ***	3.09 ***	4.63 ***	8.18 ***	3.39 ***

, ** and *** Significant at 10, 5 and 1 percent level.

Table 3. Region-wisecompound growth rates of area, production and productivity of pulses crops in Maharashtra (Overall period 1975-76 to 2012-13)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Arhar	-4.34***	-3.52**	1.46***	-1.99***	-1.46***	0.37	1.55***	2.52***	1.27*	2.51***	2.74***	0.24
Mung	6.05***	6.45***	0.42	-0.39*	1.19***	1.49***	-1.53***	-0.38	0.76	1.11**	3.67***	2.22***
Udid	0.11	3.53***	3.42***	-1.5***	-0.07	1.39***	0.71**	1.93***	1.37**	-0.86**	1.49*	2.21***
Gram	3.81***	6.44***	2.53***	2.62***	4.98***	2.3***	2.14***	4.57***	2.38***	5.05***	8.21***	3.00***

, ** and *** Significant at 10, 5 and 1 percent level.

Table 4. Period-wise compound growth rates of area, production, and productivity of major pulses in Maharashtra

Crops	Period-I (1975-76 to 1993-94)			Period-II (1994-95 to 2012-13)			Overall (1975-76 to 2012-13)		
	A	P	Y	A	P	Y	A	P	Y
Arhar	3.26***	3.3***	0.04	0.21	2.27**	2.06**	1.33***	2.43***	1.08***
Mung	2.35***	5.4***	2.98**	-3.52***	-3.16**	0.37	-0.39	1.02*	1.42***
Udid	0.10	3.39***	3.29***	-3.09***	-2.99**	0.11	-0.39	1.04*	1.43***
Gram	2.58***	5.91***	3.25***	2.86***	5.58***	2.64***	3.09***	5.72***	2.56***

, ** and *** Significant at 10, 5 and 1 percent level.

Among the pulses and regions instability measure regarding production of major pulse crops revealed that, least instability in case of arhar (20.50percent) in Vidarbha while the greater instability in case of arhar (96.55 percent) in Konkan. It might be due to greater production under crop over a shorter period.

The area instability indices of major pulse crops during Period-I indicated that arhar stood first in low instability (7.91 percent) whereas gram exhibited high instability (15.08 percent). During Period-II, high instability was showed by area under gram (15.83percent) and arhar occupied first position in low instability (6.94 percent). The high instability in area under gram was mainly due increasing area over shorter period. Instability in production of major crops shows that low instability in the case of arhar (18.75 percent) while, the high instability

Table 5. Region-wiseCuddy-Della Valle instability indices in area, production, and productivity of major pulses in Maharashtra (Period-I 1975-76 to 1993-94)

(Percent)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Arhar	29.12	41.45	29.23	16.06	25.49	16.49	7.85	28.16	26.23	9.62	22.11	16.78
Mung	66.71	62.84	33.20	12.15	31.44	22.89	6.59	33.05	29.82	16.10	43.27	34.00
Udid	16.78	46.07	32.07	8.76	28.00	28.54	11.95	38.92	35.35	7.37	38.28	32.43
Gram	27.42	38.07	19.41	15.79	28.30	17.73	11.79	33.30	23.42	24.16	43.84	23.30

Table 6. Region-wise Cuddy-Della Valle instability indices in area, production, and productivity of major pulses in Maharashtra (Period-II 1994-95to 2012-13)

(Percent)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Arhar	8.78	30.78	19.20	22.13	32.96	14.05	6.08	30.02	32.93	6.05	17.86	17.78
Mung	24.91	31.87	25.06	12.14	23.31	15.79	14.06	41.18	36.28	11.47	36.63	34.9
Udid	10.62	19.64	16.00	10.94	25.37	18.08	20.08	40.08	34.59	13.16	40.02	33.03
Gram	10.07	17.08	12.11	16.35	25.56	11.10	10.64	26.22	17.99	27.25	41.81	20.36

Table 7. Region-wiseCuddy-Della Valle instability indices in area, production, and productivity of major pulses in Maharashtra (Overall 1975-76 to 2012-13)

(Percent)

Crops	Konkan			Western Maharashtra			Marathwada			Vidarbha		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Arhar	88.31	96.55	23.92	20.12	27.59	16.34	8.16	42.04	34.15	12.21	20.50	17.27
Mung	46.04	43.91	30.92	13.87	28.83	19.57	16.02	37.13	34.86	31.67	54.08	38.92
Udid	14.90	32.45	24.78	10.50	26.45	22.65	22.05	44.90	36.04	27.40	53.60	35.13
Gram	22.93	26.05	15.19	16.98	25.09	13.95	16.75	33.32	20.63	25.25	38.22	21.04

Table 8. Period-wise Cuddy-Della Valle instability indices in area, production, and productivity of major pulses in Maharashtra

(Percent)

Crops	Period-I (1975-76 to 1993-94)			Period-II (1994-95 to 2012-13)			Overall (1975-76 to 2012-13)		
	A	P	Y	A	P	Y	A	P	Y
Arhar	7.91	19.71	17.50	6.94	18.17	17.00	10.59	18.75	18.44
Mung	10.28	35.82	26.97	10.98	28.79	25.44	19.49	39.57	26.44
Udid	7.60	29.18	22.44	12.54	29.01	23.57	14.62	34.28	23.95
Gram	15.08	31.87	19.52	15.83	27.65	13.81	15.16	26.84	15.86

in the case of mung (39.57 percent). The instability in production of major pulses has decreased during Post-Liberalization period.

CONCLUSIONS AND POLICY

In conclusion, the analysis revealed that the growth rates in area, production, and productivity of major pulses increased significantly during Period-I, The growth rates in area, production, and productivity of arhar and gram increased significantly during post-liberalization period indicating the positive effect of liberalization. Instability in production of major pulses shows that low instability in case of arhar (18.75 percent) while, the high instability in case of mung (39.57 percent). The instability in production of major pulses has decreased during Post-Liberalization period. The extent of instability was 10 percent in Maharashtra state. Thus, highest instability was due to more year to year variation in area under highest instability crops and less instability was due to less year to year variation in area under least instability crops. The higher instability in the area and production of mung and gram in Maharashtra indicated need of price stabilization measure to be implemented in the state and so also help to the farmers during overproduction of these crops by way of supportive price measures and efficient insurance cover during adverse climatic conditions.

REFERENCES

Dhillon, P.K., & Ali, J. (2002). Productivity growth in the agriculture sector of Punjab.*Agricultural Economics Research Review, 15*(2), 201-216.

Kumar, A., Kumar, J., & Kumar, P. (2013). Growth and instability in groundnut crop in India. *Asian Journal of Research in Social Sciences and Humanities, 3*(9), 218-227.

Pal, S. (1986). *Instability in agriculture production in India* (Doctoral Thesis).Division of Agricultural Economics. Indian Agricultural Research Institute, New Delhi.

Sharma, D.K., & Prakash, B. (2002). Analysis of growth and instability in area production and productivity of pulses in India. *Indian Journal of Agricultural Economics,57*(3), 397.

Singh, A.J., & Byerlee, D. (1990).Relative variability in wheat yields across countries and over time. *Indian Journal of Agricultural Economics*, *41*(1), 21-32.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 143-148
DOI: 10.5958/2322-0430.2018.00049.5

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Technology Adoption in the Wheat Crop of Western Maharashtra

C.A. Nimbalkar, S.D. Shinde, V.S. Wani and A.J. Shivgaje*

Department of Statistics, Post Graduate Institute,Mahatma PhuleKrishi Vidyapeeth, Rahuri-413722 (Maharashtra)

Corresponding author's email: canimbalkar@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-120* *Revision Accepted: March 05, 2018*

ABSTRACT

The use of new agricultural technology varies widely from farmer to farmer even in the same village. The total impact of all the components of the new agricultural technology taken together would be reflected in the level of yield obtained due to non-adoption or partially adoption. The study has been undertaken considering the need, availability and the area under wheat crop in Western Maharashtra. The method of PCA has been used to develop indices for technology adoption to know the impact in case of the wheat production alongwith the contribution of each component of technology in wheat production. Out of 319wheat cultivators 43.57, 55.49 and 0.94 percent were categorized in low, medium and high adoption group, respectively. The recommended technologies properly adopted by low and medium adoption groups were soil type, sowing time, sowing method and seed rate for the wheat production. The Preparatory tillage (8.78percent), time of sowing (8.71 percent), seed treatment (15.33 percent), improved variety (7.21 percent), nutrient management (40.90percent) and growth stage-wise irrigation management (13.55percent) were the major contributing technologies in the wheat productivity have explained 85.77 percent contribution in wheat productivity. The major recommended technologies including preparatory tillage (1 ploughing, 1 harrowing),time of sowing(15th Oct. to 15th Nov.), improved varieties, seed treatment (Capton/Thirum 3 g /kg, Azotobactor 250 g/10 kg with 250 g PSB, Deltamethrin 2.8percent liquid 4 ml or Lufemiron 5percent liquid 10 ml),application of nitrogen, phosphorus and potash (120, 60 and 40 kg ha^{-1}, respectively) and growth stage-wise irrigation management (1. 18-21, 2. 40-45, 3. 60-65and 4. 80-85 days after sowing)influenced the wheat productivity to the extent of 85.77 per cent. Hence, these technologies are widely popularized among the farmers to achieve the potential wheat yield.

Keywords
Adoption indices, contribution, PCA, technology, wheat.

JEL Codes
Q12, Q16, C22.

INTRODUCTION

Adoption of recommended technologies to get the optimum level of output, farmers have to face many constraints and these constraints reduce the potential production of crops and affect total agricultural production. The use of new agricultural technology varies widely from farmer to farmer even in the same village. Hence, under these conditions total impact of all the components of the new agricultural technology taken together would be reflected in the level of yield obtained.

Wheat is a grass widely cultivated for its seed, a cereal grain which is a worldwide staple food. There are many species of wheat which together make up the genus *Triticum*; the most widely grown is common wheat (*T. aestivum*). The archaeological record suggests that wheat was first cultivated in the regions of the Fertile Crescent around 9600 BCE. Botanically, the wheat kernel is a type of fruit called a caryopsis.

Wheat is grown on more land area than any other food crop (220.4 million hectares). World trade in wheat is greater than for all other crops combined. In 2016, world production of wheat was 749 million tonnes, making it the second most-produced cereal after maize. Since 1960, world production of wheat and other grain crops has tripled and is expected to grow further through the middle of the 21st century (Commissionorate of Agriculture, 2016). Global demand for wheat is increasing due to the unique viscoelastic and adhesive properties of gluten proteins, which facilitate the production of processed foods, whose consumption is increasing as a result of the

worldwide industrialization process and the westernization of the diet. Wheat is an important source of carbohydrates. Globally, it is the leading source of vegetal protein in human food, having a protein content of about 13 percent, which is relatively high compared to other major cereals, but relatively low in protein quality for supplying essential amino acids. When eaten as the whole grain, wheat is a source of multiple nutrients and dietary fiber. Considering the need, availability and the area under wheat crop in the jurisdiction of Western Maharashtra is selected for the study.

The technological development has taken place in different crops according to their situational requirement. These techniques have been essential somewhere partially and somewhere fully depending upon the adoption of different techniques for individual crop or as a whole. So, the impact of techniques adopted could be quantified in terms of increase in production. To identify the importance of technique(s) adopted, several kinds of indices were developed by different scientists for quantification of the contribution of different techniques in various crops for different purposes. Therefore, in the present case also out of all the techniques and indices, the principal component analysis has been utilized to index the importance of the technique(s). Singh & Chahal (2009); Balai *et al*. (2013); Samui *et al*. (2000); Purushottam *et al*. (2012); Nimbalkar *et al*. (2016) conducted the study on technology adoption in wheat, vegetables, groundnut pulses and gram adopting different methodologies, respectively.

Keeping this in view, the method of PCA has been used to develop indices for technology adoption to know the impact in case of the wheat production with the following objectives:

I. to examine the technologies adopted by the farmers in wheat production,
ii. to estimate adoption indies for wheat production, and
iii. to measure the contribution of each component of technology in wheat production.

MATERIAL AND METHODS

Secondary data was procured from the Agricultural Research Officer, The Scheme for Strengthening of Research in Agricultural Economics, MPKV, Rahuri during the year 2014-15 to 2016-17.

Recommended Technology

The term recommended technology refers to the cultivation practices recommended by the University for wheat. For the present study, the recommended technologies developed by the Mahatma Phule Krishi Vidyapeeth, Rahuri for wheat crop were used (Mahatma Phule Krishi Vidyapeeth, 2017). Technologies developed by SAU's for the cultivation of wheat were recorded by consulting the Wheat Specialist and MPKV, *Krishidarshani* (diary). The recommended technology levels along with measurement units are presented in following Table 1.

Adoption of Technology

Adoption of technology refers to actual practices adopted by the farmers for cultivation of the wheat crop.

Levels of Adoption of Technology

The University has undertaken various research programs for different crops. They have made various recommendations about the wheat production technologies. For the present study soil type, preparatory tillage, time of sowing, improved varieties, seed rate, seed treatment, the method of sowing, fertilizer doses (N, P, and K), plant protection measures and irrigations were studied.

The Extent of Adoption of Technology

The actual level of adoption of each item of technology was identified. Using the SAU's recommended technologies, the efficiency of each technology was calculated. All the efficiency scores were scaled down to 0 to 1 and all the groups of farmers were classified as zero adoption, greater than zero to 0.5, 0.5 to 0.8 and 0.8 to 1. The efficiency of each technology was calculated with the help of following formula.

$$\text{Adoption of particular practices} = \frac{\text{Practices actually adopted}}{\text{Practices recommended}}$$

Technology-wise Extent of Adoption

Development of Composite Index

Development of index by Principal Component Analysis

The main objectives of the principal component analysis are to refer the dimension of a complex multiplicative problem. It is not uncommon if the variations in variables, some of which are closely correlated with one another. In this situation, the multiple regression analysis often fails to provide clear and meaningful analysis. The coefficient of independent variables become unreliable and sometimes carries wrong signs in this situation. Since these become distorted by the inclusion of another independent variable with which these show a high degree of association. The component analysis, on the other hand, takes the correlation matrix into account and produces components which are uncorrelated with one another, to bypass the problem of multicollinearity.

Secondly, the component analysis produces components in descending order of their importance that is the first component explains the maximum amount of variation and the last component minimum. It is further found that first 5 or 6 variables account for a sizeable amount of variation of about 75 percent. It is, therefore, possible to represent all variables in terms of Eigen components.

The efficiency of any choice of k linear functions depends on the extent to which the k linear functions enable us to reconstruct the p original variables. One method of reconstructing the variables U_i is by determining its best linear predictor on the basis of k linear functions, which case the efficiency of prediction,

may be measured by the residual variance λ^2_i. An overall measure of the predictive efficiency is $\Sigma \lambda^2_i$. The best choice of the linear functions, for which $\Sigma \lambda^2_i$ is minimum is the first k principal components of U (Kleinbaum & Kupper, 1978).

Development of the composite index of technology

The components of technology recommended by the University for wheat in terms of adoption scores (X_1,..... , X_n) was utilized for developing the composite index of technology adopted. A composite index is a single numerical value representing the net adoption of all components of technologies whose values lie in between 0 and 1. The principal component analysis (PCA) approach was used for developing the composite index. PCA based on correlated variables was on matrix between k^{th} components of technology computed. A set of k components explaining 100percent of total variation of all components of recommended technologies was considered correlation matrix where the row represents variables and columns represents Eigen-vectors from which weight (W_i) coefficients of components ofthe technology say Σ is determined as,

$$W_i \quad \frac{M_i}{M_i}$$

Where,

W_i = Weight or coefficient of the component of technology.

M_i = Maximum element in the ith row.

The required linear function forderiving composite index is,

$S_i = W_1X_1 + W_2X_2 + ... + W_nX_n$

Where,

S_i = composite index score.

$X_i^{'s}$ = adoption scores for an individual component of technology.

This provides adoption index (of all components of technologies) for each cultivator. The composite index obtained in the process lie in between 0 and 1.

The composite score of farmers was classified as low-level adoption (40-60 percent) medium level (60-80 percent) and high level of adoption (above 80 percent).

To measure the contribution of each component of technology

To measure the contribution of each component of technologies in the yield the data collected from what was used along with the adoption level of technologies. The number of cultivators over the districts in Western Maharashtra was 319.The farmers who have not adopted all the technologies were deleted from contribution analysis considering the size of farmers.

The yield is considered as a function of the level of adoption and the contribution of each technology in yield

Table 1. Recommended packages of practices for wheat crop

Technology	Component
Soil type	Medium to heavy and deep but well-drained soils (sandy loam to clay soil but best grown on loamy soil)
Preparatory tillage	1 ploughing, 4 harrowing
Time of sowing	15th October to 15th November
Method of sowing	Broadcasting, dibbling or drilling
Improved varieties	NIAW-301 (Trimbak), NIAW-917 (Tapovan), MACS-6222, NIDW-295 (Godawari), NIAW-34, AKAW-4627, NIDW-15 (Panchvati), AKDW- 2997-16 (Sharad), NIAW-1415 (Netravati) and NIAW-1994 (PhuleSamadhan)
Seed rate	100-125 kg/ha
Seed treatment	Capton/Thirum: 3 g /kg Azotobactor 250 g/10 kg with 250 g PSB Deltamethrin 2.8percent liquid 4 ml or Lufemiron 5percent liquid 10 ml
Fertilizers	
N	120 kg ha^{-1}
P	60 kg ha^{-1}
K	40 kg ha^{-1}
Irrigation	18-21 days after sowing 40-45 days after sowing 60-65 days after sowing 80-85 days after sowing
Plant protection	Pest management : Thiomithoxam 25 wg 50 g + 500 l water Disease Management : Mancozeb 1.5 kg with 500 l water – spraying Copper oxycloride 0.2 percent + Mancozeb 0.2 percent - 2 sprays after 15 days

will be worked out by fitting linear regression between the level of adoption of each technology and yield gap.

$$Z_{ij} \quad \frac{[X_{ij} \quad X_j]}{S_i}$$

$$Where \ , S_j^2 \quad \frac{{}_1^n[X_{ij} \quad \bar{X}_j]^2}{n}$$

$$\bar{X}_j \quad \frac{{}_1^n X_{ij}}{n}$$

I = 1, 2, 3, -- n and j = 1, 2, 3, -- k

Z_{ij} denotes the matrix of standardized indicators.

Actual yield by the farmer was regressed on the standardized value of indicators and best fit was obtained. The contribution of each indicator in yield was studied to arrive concluding the yield and technological adoption gap.

RESULTS AND DISCUSSION

Using the method of Principal Component Analysis, the composite indices for individual farmers have been worked out. All the farmers under study were grouped according to composite index ranging from 0.00 to 0.60 in low, 0.60 to 0.80 in medium and above 0.80 in high technology adoption groups. It is evident from Table 2 that the 139 farmers categorized under low technology adoption group. Accordingly, 177 farmers categorized in medium technology adoption group, while only three farmers coming under high technology adoption group. The composite index of individual farmer showed the adoption of recommended technologies in the wheat cultivation.

The Composite Index of Adoption

Eigen value and proportion of selected technologies in wheat production are presented in Table 3. The total 319 cultivators have been classified according to their adoption level as low, medium and high adopters.

Technology Adopted by Wheat Cultivators

The average of individual technology adopted by group of farmers has been presented in Table 4 indicated that the level of level of adoption is near about equivalent for soiltype adopted by wheat cultivators type (1.0, 0.99 and 0.81) sowing time (1.0, 0.95 and 0.64), method of sowing (1.0, 0.88 and 0.65) and seed rate (1.0, 0.97 and 0.86), seed treatment (1.0, 0.86 and 0.67) and irrigation management (1.0, 0.99 and 0.82),in high, medium and low groups, respectively. It is also noticed that the preparatory tillage, application of N, P and K fertilizers and plant protection indices were less in low and medium adoption group as compared to high adoption group which indicates the benefit of technology adoption (Table 4).

The yield harvested by the selected cultivators ranged from 17.51(Low), 23.79 (Medium) and 33.41 (High) q/ha. The non-adoption practices at its recommended level have reduced yield below 49.98 percent than the potential yield (Table 4).

Table 2. The technology-wise extent of adoption for gram crop

Practices	Extent of adoption
Soil type	EA= Land use by cultivators / Recommended Land
Preparatory tillage	EA= Preparatory tillage used by cultivators / Recommended preparatory tillage
Time of sowing	EA= No of days delayed for sowing / Recommended time of sowing
Method of sowing	EA= Method used by cultivators / Recommended method
Improved variety	EA= Variety used by cultivators / Recommended variety
Seed rate	EA= Seed rate used by cultivators / Recommended seed rate
Seed treatment	EA= Seed treatment used by cultivators / Recommended seed treatment
Fertilizers (N)	EA= Nutrient applied by cultivators (N) / Recommended dose of nutrients (N)
Fertilizers (P)	EA= Nutrient applied by cultivators (P) / Recommended dose of nutrients (P)
Fertilizers (K)	EA= Nutrient applied by cultivators (K) / Recommended dose of nutrients (K)
Irrigation	EA= No of irrigations / Recommended irrigations
Plant protection	In case of plant protection recommendations, the farmers who have used plant protection measures get to score one and those who have not used they get the score zero.

Table 3. Eigenvalue and proportion of technologies

Eigenvalue	Difference	Proportion	Cumulative
2.0136	0.4781	0.1678	0.1678
1.5355	0.166	0.128	0.2958
1.3695	0.1794	0.1141	0.4099
1.1901	0.1679	0.0992	0.5091
1.0222	0.0243	0.0852	0.5942
0.9979	0.1866	0.0832	0.6774
0.8113	0.0693	0.0676	0.745
0.742	0.0585	0.0618	0.8068
0.6835	0.0799	0.057	0.8638
0.6036	0.0649	0.0503	0.9141
0.5387	0.0465	0.0449	0.959
0.4921		0.041	1

The Contribution of Technologies in Yield

The abstract of contribution of wheat cultivation technologies for the wheat productivity indicated that the application seed treatment (15.33 percent), N fertilizer 10.66 percent), P fertilizer (13.02 percent), K fertilizer (17.23 percent), and irrigation management (13.55 percent) were the major significant contributors to the wheat production (Table 5). On the other hand preparatory tillage (8.78 percent) and time of sowing (8.71 percent) had also played a contributory role in wheat productivity in the practical field. The contribution of each technology in yield in wheat production is presented in Table 4. These findings are in consonance with the results of Vidyasagar (1978); Nimbalkar *et al*. (2016).

CONCLUSIONS

1) In wheat production, preparatory tillage, sowing time, seed treatment, fertilizer doses of N, P, K, and irrigation are major contributors to wheat production. Out of these 12 technologies, three technologies *viz*., seed treatment, application N, P and K, and irrigation have explained 69.78 percent contribution in wheat productivity.
2) The technology adoption composite indices have resulted in 139 (43.57 percent) cultivators in a low level of adoption group and 177(55.49 percent) in medium adoption group out of 319 wheat cultivators. Only

Table 4. Technology adopted by wheat cultivators

Technology	Level of adoption		
	High (> 0.80)	Medium (0.60-0.80)	Low (< 0.60)
Soil type	1.00	0.99	0.81
Preparatory tillage	0.50	0.32	0.28
Time of sowing	1.00	0.95	0.64
Method of sowing	1.00	0.88	0.65
Improved variety	1.00	0.69	0.60
Seed rate	1.00	0.97	0.86
Seed treatment	1.00	0.86	0.67
N	0.92	0.30	0.15
P	0.42	0.40	0.16
K	0.92	0.52	0.18
Irrigation management	1.00	0.99	0.82
Plant protection	0.22	0.27	0.21
CI	0.83	0.68	0.51
Main produce (q/ha)	33.41	23.79 (28.79)	17.51 (47.59)
No. of respondents	3	177	139
percent of total respondents	0.94	55.49	43.57

Figures in parentheses indicate percent increase of wheat productivity of high adopters group over respective technology adopters group.

Table 5. The contribution of technologies in wheat productivity

Technology	Contribution (percent)	Group of technology	Contribution (percent)
Soil type	0.27		0.27
Preparatory tillage	8.78***	Inter-culturing	17.79
Time of sowing	8.71***		
Method of sowing	0.30		
Improved variety	7.21***	Seed	25.95
Seed rate	3.41		
Seed treatment	15.33**		
N	10.66***	Nutrient management	40.90
P	13.02***		
K	17.23***		
Irrigation management	13.55***		13.55
Plant protection	1.54		1.54

****** and ** Significant at 1 and 5 percent level.***

three (0.94 percent) cultivator found in high adoption category. Wheat yield of high adopters group was exhibited 28.79 and 47.59 percent more than the medium and low adopters groups, respectively.

3) The recommended technologies were not properly adopted by low and medium adoption groups are preparatory tillage, application of N, P and K fertilizers and irrigation management for the wheat production.

POLICY IMPLICATION

Preparatory tillage, time of sowing, seed treatment, improved variety, nutrient management and growth stage-wise irrigation management were the major contributing technologies in the wheat productivity. Hence farmers should adopt these technologies to the maximum extent to achieve the potential wheat yield.

REFERENCES

Balai, C.M., Jalwania, R., Verma L.N., Bairwa, R.K., & Regar, P.C. (2013). Economic impact of frontline demonstrations on vegetables in the tribal belt of Rajasthan. *Current Agriculture Research Journal, 1*(2), 69-77.

Commissionorate of Agriculture. (2016). *District-wise general statistical information of agricultural department. Part II-Epitome of agriculture in Maharashtra*. Mumbai: Commissionorate of Agriculture, Government of Maharashtra.

Kleinbaum, D.G., & Kupper, L.L. (1978). *Applied regression analysis and other multivariable Methods*. N.S. Massachusetts: Duxbury Press.

Mahatma Phule Krishi Vidyapeeth. (2017). *Krishidarshani*. Mahatma PhuleKrishiVidyapeeth, Rahuri.

Nimbalkar, C.A., Shinde, S.D., & Wani. V.S. (2016). Adoption of technology for cultivation of gram in Western Maharashtra. *Bioinfolet, 13*(2A), 219-222

Purushottam S.K., Singh, S.K., Chaudhary, R.G., Kumar, R., & Praharaj, C.S. (2012). Assessment of technological inputs for major pulses in Bundelkhand region. *Journal of Food Legumes, 25*(1), 61-65.

Samui, S. K., Maitra, S., Roy, D.K., Mondal A.K., & Saha, D. (2000). Evaluation of frontline demonstration on groundnut (*Arachis hypogea* L). *Journal of Indian Society of Coastal Agriculture Research, 18*, 180-183.

Singh, M., & Chahal, S.S. (2009). A study on the extent of adoption of various technologies in wheat cultivation in Punjab. *Agricultural Economics Research Review, 22*, 349-354.

Vidyasagar. (1978, June 24-30). Contribution of individual technological factors in agricultural growth-A case study of Rajasthan. *Economic and Political Weekly, 25*, A63-A67.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 149-154
DOI: 10.5958/2322-0430.2018.00050.1

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Effect of Weather Variables on Wheat Productivity in Punjab, India

Amrit Kaur Mahal[1] and Manjeet Kaur[2]*

[1]Professor, Department of Mathematics, Statistics and Physics, and [2]Senior Economist
Department of Economics and SociologyPunjab Agricultural University, Ludhiana-141004

[*]Corresponding author's email: akmahal@pau.edu

Received: January 15, 2018 *Manuscript Number: NS-18-123* *Revision Accepted: March 07, 2018*

ABSTRACT
The study was aimed to determine effect of weather variables namely minimum temperature, maximum temperature, relative humidity, sunshine hours and rainfall on wheat productivity. Thus trends in monthly data of weather variables had been studied from 1971-72 to 2014-15 for wheat growing period in Punjab. The results had shown that during period of forty five years maximum temperature had significantly decreasing trend during month of January but significant increasing trend during March whereas minimum temperature had significantly increasing trend during all months from November to April. Sunshine hours had declined significantly whereas relative humidity increased significantly during wheat growing period. Wheat productivity was detrended using logistic model, which was found to be most suitable, to remove effect of technological change overtime. Effect of different weather variables were studied on detrended wheat productivity.

Keywords
Logistic model, maximum temperature, minimum temperature, relative humidity, wheat productivity.

JEL Codes
O44, Q10, Q54.

INTRODUCTION

Punjab is most progressive agricultural state with only 1.53 percent of geographical area of India, producing 20 percent of wheat of country and 2.5 percent of world production. The normal wheat sowing period extends from last week of October to third week of November. In some parts of the state, late sowing is however continued up to December. Although the overall productivity of crops is increasing but the wheat productivity has declined during the years 1999-2000 (4.7 t/ha) to 2006-07 (4.2 t/ha) in Punjab. It seems to be effect of climate change as input use continued to increase during these years.

Temperature is key climatic variable that determines the wheat growth and ultimately the yield. High temperature during the early growth stages is unfavourable for tillering while during later growth stages it reduces the duration of grain formation and hinders proper grain filling. Castro *et al.* (2007) reported that exposure of wheat plants to high temperature reduced the length of grain fill period. Unusual changes in weather parameters, especially an increase in maximum/minimum temperature from normal at any growth stage of crop adversely affects the growth and ultimately the potential yield of wheat. The analysis of the historical meteorological and yield data revealed that in the years when there is an unusual rise in temperature during the months of March and April, yield per hectare falls considerably. According to IPCC (2007), the rate of warming has been much higher in the recent decades and the night time minimum temperatures have been increasing at twice the rate of daytime maximum temperatures.

The impact of weather elasticities on wheat productivity has been illustrated at Ludhiana (Punjab) where it requires a minimum temperature of 3-4°C, optimum of 25°C and a maximum of about 30-32 °C for its growth and development. Kaur & Hundal (2010) reported that at Ludhiana for the months of January, February, and March the most favourable maximum temperatures for wheat yields were in the range of 16.1-18 °C, ≤21°C, and 28.1-30°C, respectively while minimum temperature were in the range of 3.1-5°C, 5.1-7°C, and 11.1-13°C,

respectively.

In the recent years despite of remarkable growth in food production, numerable risks were exposed by food crisis due to weather variability. Wheat production must continue to increase by 2 percent annually, more particularly in developing world including south-east Asia until 2020 to meet future demands imposed by population and prosperity growth (Reynolds *et al.,* 2008). It is well known that one of main factors causing yield to change from year to year is climate variability as no two growing seasons experience exactly same weather. It was, therefore, considered worthwhile to analyze effect of weather variables on wheat productivity. So this study was an attempt in this direction for the wheat crop in Punjab with the objectives to examine the extent of changing pattern of weather variables during the crop growing period, to assess the contribution of technology on productivity of wheat and analyze effect of weather variables on wheat yield.

MATERIALS AND METHODS

Study Area

The study area is Ludhiana district of Punjab, India. It stands on Sutlej river's bank south of its present course. Ludhiana features a humid subtropical climate under Koppen climate classification with three defined seasons; summer, monsoon, and winter. Ludhiana on average has roughly 730 millimeter of precipitation annually.

Data

The daily weather data from 1st November to 30th April (wheat growing period/winter season) on maximum temperature, minimum temperature, sunshine hours, rainfall, relative humidity in morning and relative humidity of evening from 1970 to 2015 were collected from the meteorological observatory located in Punjab Agricultural University (PAU), Ludhiana (Punjab). The daily weather data were classified month wise for the analysis purpose. Averages were calculated for all variables except rainfall, where total rainfall was considered for analysis; for monthly as well as for the whole period also referred as winter season. The data on yield of wheat from 1971-2015 for Ludhiana district of Punjab was collected from the Statistical abstracts of Punjab.

Techniques to Apply

Mann-Kendall test

To examine the extent of changing pattern of weather variables during the crop growing period Mann-Kendall test (MK test) was be used. Mann-Kendall test is the non-parametric test for identifying trend in time series data. The test compares the relative magnitudes of the sample data rather than data values themselves.

$$S \quad {}_{k\ 1}^{n\ 1}\ {}_{j\ k\ 1}^{n}\ \mathrm{sgn}(x_i \quad x_k)$$

$$\mathrm{sgn}(x_i \quad x_k) \quad \begin{matrix} 1\ if\ x_j \quad x_k \quad 0 \\ 0\ if\ x_j \quad x_k \quad 0 \\ 1\ if\ x_j \quad x_k \quad 0 \end{matrix}$$

Where n is number of observed data series, x_j & x_k are value of temperature is periods $_J$ & $_K$ where $_J > _K$

A very high positive value is indicator of increasing trend

A very low negative value indicate a decreasing trend

To test significance of trend, normal approximation test is used for n> 10,

$$Z \quad \frac{S \quad 1}{\sqrt{Var\ (s)}}\ ifs > 0$$

$$VAR\ (s) \quad \frac{1}{18}\ n(n \quad 1)(2n \quad 5) \quad {}_{p\ 1}^{q}\ t_p(t_p \quad 1)(2t_p \quad 5)$$

Where q is the number of tied group and t_p is the number of data values in the p-th group.

A positive value of Z indicates an upward trend, whereas negative value indicates a downward trend.

De-trending method

The year to year variations of crop yield are largely driven by climate. The crop management improvements including improved varieties, fertilizers, insecticides, and pesticides have contributed to crop yield in past decades. To evaluate the impact of climate variation on crop yield, the yield increase driven by technological improvement needs to be excluded. Thus nonlinear growth models were selected to remove the contribution of technology on productivity of wheat (1970 to 2015). For this, three non linear growth models, viz. monomolecular, logistic, and Gompertz, were tried.

Monomolecular: $y_t = c-(c-b)\exp(-a\ t) + e_t$

Logistic Model: $y_t = c/[(1 + b\exp(-a\ t)] + e_t$

Gompertz Mode: $y_t = c\exp(-b\exp(-a\ t)) + e_t$

Where y_t : wheat productivity (q/ha), t : time variable (Year),

a, b, c : parameters to be estimated , e_t: error term

Step-wise regression model

To identify effect of monthly major weather variables affecting de-trended wheat productivity, step-wise regression analysis had been used. It evaluates all weather variables for their potential contributions to wheat yield variation and excludes variables not statistically significant in the multiple regression models($p \leq 0.25$). Procedures using stepwise regression have the advantage that they allow the use of a small subset of least correlated variables without losing a significant portion of the explanatory power of the data, thus minimizing the effects of multicol linearity on the regression model (Huang &Townshend, 2003).

$Y = \beta_1 X_1 + \ldots + \beta_k X_k$

Where Y: de-trended productivity,

X_i's explanatory variables for monthly data of Maximum temperature (MAX), Minimum temperature (MIN), Rainfall (Rain), Sun shine hours (SSH), Relative humidity of morning (RHM) and Relative humidity of evening (RHE): Max_Nov, Max_Dec, Max_Feb, Max_Jan, Max_Mar, Max_Apr, Min_Nov, Min_Dec, Min_Feb, Min_Jan, Min_Mar, Min_Apr, Rain_Nov,Rain_Dec, Rain_Feb, Rain_Jan, Rain_Mar,

Rain_Apr, SSH_Apr, SSH_Dec, SSH_Feb, SSH_Jan, SSH_Mar, SSH_Nov, RHM_Apr, RHM_Dec, RHM_Feb, RHM_Jan, RHM_Mar, RHM_Nov, RHE_Nov, RHE_Dec, RHE_Feb, RHE_Jan, RHE_Mar, RHE_Apr

RESULTS AND DISCUSSION

Characterization of Climatic Conditions at the Study Area

The coefficient of variation was calculated to evaluate the variability of weather variables and wheat yield (Table 1). Wheat yield was having 17.48 percent of variability, ranging from 28.23 q/ha to 53.75 q/ha (mean: 41.3±1.08 q/ha). The rainfall was highly variable factor (CV > 35), while maximum temperature, minimum temperature, sunshine hours, relative humidity in morning and evening were slightly variable factors (CV < 15). Changes have been found in the rainfall amount and distribution as well as in temperature (Anuforum, 2015).

Trends in Weather Variables

Trend and direction of trend in weather variables during winter season is estimated by nonparametric MK test; the summary of results of the test is presented in Table 2. The results were calculated separately for winter season (November to April) and individually for each month of wheat season for Ludhiana district of Punjab.

During the wheat season, the significantly increasing trend in maximum temperature, minimum temperature, relative humidity of morning and relative humidity of evening whereas sunshine hours had significant negative trend, while rainfall had no trend. The month wise analysis showed that maximum temperature depicted different trends i.e. an insignificant downward trend in December ($p = 0.29$) but significant downward trend in January ($p = 0.00$) whereas increasing trend during November ($p = 0.07$), February ($p = 0.16$), March($p = 0.01$) and April ($p = 0.18$) . Thus extreme cold months of December and January showed declining trend in maximum temperature. A significant increasing trend in minimum temperature was observed for all months of wheat crop. The sunshine hours showed significantly declining trend during November, December, January, and February but increasing trend during March, whereas during April non-significant declining trend was observed.

Rainfall depicted non-significant mixed trend in monthly data; in two out of six months. The rainfall trends were negative during November and March whereas increasing trend was observed during months of December, January, February, and April. Rainfall showed increasing trend during the months of December and January, which is traditionally a winter monsoon period. Rainfall in April is not considered good for wheat crop as this is harvesting season of crop.

Relative humidity during morning as well as evening showed significantly increasing trend during November, December, January, February, and March except month of April which showed non-significant declining trend might be due to increasing trend in temperature during April that relative humidity declined.

A glance at these trends presents an interesting pattern; an upward trend in minimum temperature, relative humidity in morning and relative humidity in evening is associated with upward trend in rainfall. Rain thus appears to have been increasing the minimum temperature, relative humidity in morning and evening during winter season.

Detrend Wheat Yield

Nonlinear relationship of yield with technological change over time period from 1971 to 2015 had been analyzed by models depicted in Table 3.

Goodness of fit statistics calculated for monomolecular, logistic and Gompertz model did not showed much variation (Figure 1). But logistic model had minimum value of Mean Absolute Error (MAE), Mean Square Error (MSE), Mean Percentage Error (MPE), Mean Absolute Percentage Error (MAPE) and highest coefficient of determination (R^2) in comparison to monomolecular and Gompertz model

Thus logistic model was found to be appropriate for describing relationship of productivity over time for technological progress. The effect of technological progress was removed from productivity by fitting

Table 1. Variability of weather variables and yield of wheat

Variable	Mean	Standard deviation	Standard error	Coefficient of variation	Minimum	Maximum
Yield	41.30	7.22	1.08	17.48	28.23	53.75
Maximum temperature (MAX)	24.64	0.80	0.12	3.25	22.60	26.02
Minimum temperature (MIN)	10.00	0.91	0.14	9.09	8.10	11.72
Rain fall (Rain)	124.36	69.42	10.35	55.82	23.90	318.50
Sun shine hours (SSH)	7.88	0.71	0.11	9.00	6.41	9.07
Relative humidity in morning (RHM)	88.29	2.05	0.31	2.32	82.88	92.39
Relative humidity in evening (RHE)	44.06	4.85	0.72	11.01	32.56	53.41

Table 2. Weather variables trends in Ludhiana district of Punjab during winter season

Particulars		November	December	January	February	March	April	Winter
MAX	S	153	-58	-292	101	237	94	120
	Z	1.49	-0.56	-2.85	0.98	2.31	0.91	1.16
	p	0.07	0.29	0	0.16	0.01	0.18	0.12
MIN	S	284	309	279	492	533	348	621
	Z	2.77	3.01	2.72	4.8	5.2	3.39	6.06
	p	0	0	0	0	0	0	0
SSH	S	-465	-426	-398	-287	135	-35	-472
	Z	-4.54	-4.16	-3.88	-2.8	1.31	-0.33	-4.6
	p	0	0	0	0	0.1	0.37	0
Rain	S	-120	63	66	19	-5	103	0
	Z	-1.66	0.62	0.64	0.18	-0.04	1	0
	p	0.05	0.27	0.26	0.43	0.48	0.16	0.5
RHM	S	385	317	428	382	398	-32	395
	Z	3.76	3.09	4.18	3.73	3.88	-0.3	3.85
	p	0	0	0	0	0	0.38	0
RHE	S	121	305	461	312	106	-54	408
	Z	1.17	2.97	4.5	3.04	1.03	-0.52	3.98
	p	0.12	0	0	0	0.15	0.3	0

Z-value positive/ negative indicates increasing/ decreasing trend.
p ≤0.05 indicates significant trend at 5 % level of significance.

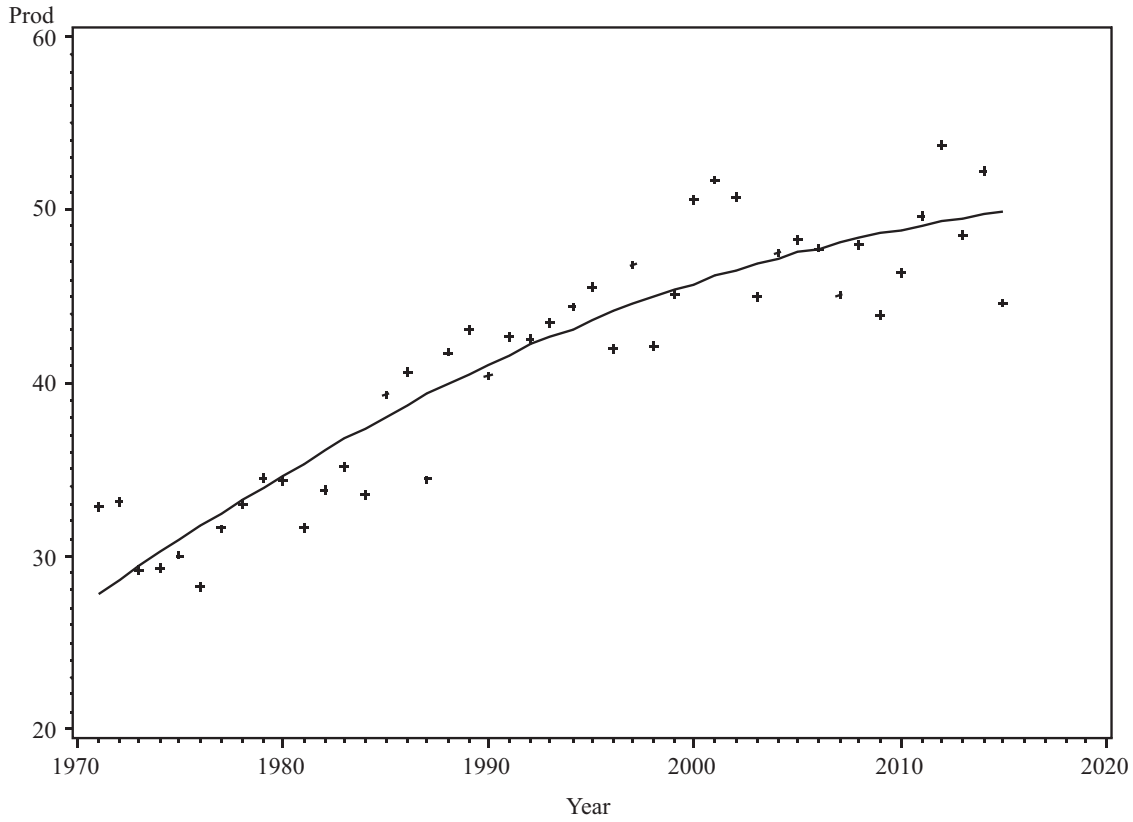


Figure. 1. Logistic model trend line

logistic model and detrended data had been further analyzed to see effect of climate variables.

Impact of Climate Variables on Wheat Yield

Using step-wise regression analysis the effect of monthly weather variables on detrended wheat productivity had been studied and presented in Table 4. The results depicted significant increasein wheat productivity by a unit quintal with significant increase in minimum temperature of November by 0.72^{0}C ($p < 0.05$), sunshine hours of November by 0.77 ($p < 0.05$), maximum temperature of December by 0.31^{0}C ($p < 0.10$), relative humidity in morning of January by 0.35 ($p < 0.05$) and sunshine hours of March by 0.90 ($p < 0.10$). Whereas significant decline in relative humidity of morning in November by 0.15 ($p = 0.2$), relative humidity of evening in February by 0.21 ($p < 0.01$), sunshine hours in February by 1.43 ($p < 0.01$), April by 1.63 ($p < 0.01$) and minimum temperature of March by 0.72^0 C ($p < 0.05$) had positive effect on wheat productivity. These factors contributed to 55 percent variation in wheat productivity. The effect of rain on wheat productivity was not significant as bulk of the wheat had been cultivated on assured irrigated area.

Table 3. Parameters of non linear growth models for wheat yield

Model	Monomolecular	Logistic	Gompertz
y	c-[(c-b) exp (-a t)]	c/[(1+b exp (-a t)]	c exp [(-b exp (-a t)]
c	59.7215 (7.6197)	53.4031 (3.0113)	55.6207 (4.3923)
b	26.9509 (1.5652)	0.9713 (0.0918)	0.722 (0.0606)
a	0.0278 (0.0116)	0.0587 (0.0126)	0.043 (0.0121)
Goodness of fit statistics			
MAE	2.2159	2.1376	2.1737
MSE	7.7125	7.3238	7.5094
MPE	-0.4613	-0.3989	-0.4276
MAPE	5.5085	5.2952	5.3941
R^2	0.8487	0.8563	0.8527

Figures with in the brackets indicate corresponding standard errors.

CONCLUSIONS

The study using nonparametric MK test revealed significantly increasing trend in maximum temperature, minimum temperature, relative humidity of morning and relative humidity of evening whereas sunshine hours had significant negative trend, while rainfall had no trend during the wheat season in Ludhiana district of Punjab. The results of step-wise regression analysis depicted significant increase in wheat productivity by a unit quintal with significant increase in minimum temperature of November by 0.72^{0}C ($p < 0.05$), sunshine hours of November by 0.77 ($p < 0.05$), maximum temperature of December by 0.31^{0}C ($p < 0.10$), relative humidity in morning of January by 0.35 ($p < 0.05$) and sunshine hours of March by 0.90 ($p < 0.10$). Whereas significant decline in relative humidity of morning in November by 0.15 ($p = 0.2$), relative humidity of evening in February by 0.21 ($p < 0.01$), sunshine hours in February by 1.43 ($p < 0.01$), April by 1.63 ($p < 0.01$) and minimum temperature of March by 0.72^{0}C ($p < 0.05$) had positive effect on wheat productivity. These factors contributed to 55 percent variation in wheat productivity. The effect of rain on wheat productivity was not significant as the bulk of wheat crop had been cultivated on assured irrigated area.

Table 4. Analysis of variance of the fitted regression

Source	DF	Sum of squares	Mean square	F-value	Pr>F
Model	10	180.66588	18.06659	4.25	0.0007
Error	35	148.90370	4.25439		
Uncorrected total	45	329.56958			

Table 5. Estimates of regression adjusted parameters of weather variables for wheat yield

Variable	Parameter estimate	Standard error	Type II SS	F-value	Pr>F
Max_Dec	0.31109	0.18297	12.29886	2.89	0.0980
Min_Nov	0.71796	0.31410	22.22768	5.22	0.0284
Min_Mar	-0.72154	0.32658	20.76708	4.88	0.0338
SSH_Apr	-1.62957	0.49111	46.84056	11.01	0.0021
SSH_Feb	-1.43358	0.49973	35.01106	8.23	0.0069
SSH_Mar	0.89619	0.48609	14.46105	3.40	0.0737
SSH_Nov	0.76809	0.33905	21.83418	5.13	0.0298
RHM_Jan	0.34680	0.16823	18.07890	4.25	0.0468
RHM_Nov	-0.15391	0.11886	7.13392	1.68	0.2038
RHE_Feb	-0.21259	0.06428	46.52865	10.94	0.0022

REFERENCES

Anuforum, A.C. (2015). Food and nutrition security in the face of climate change 2015. Paper presented at *Proceedings of Soil Science Society Nigeria.* Conference Landmark University, Omu-Aran, Kwara state, 16-18.

Castro M, Peterson, C.J., Rizza, M.D., Dellavalle, P.D., Vazquez, D., Ibanez, V., & Ross, A (2007). Influence of heat stress on wheat grain characteristics and protein molecular weight distribution. In H.T. Buck, J.E. Nisi, & N. Salomon (Eds.). *Wheat production in stressed environment* (pp. 365-371). Dordrecht, The Netherlands: Springer.

Huang, C., & Townshed, J.R.G. (2003). A stepwise regression tree for non-linear approximation: Applications to estimating subpixel land cover. *International Journal of Remote Sensing, 24*, 75-90.

IPCC. (2007). Summary for policymakers. In Parry, M.L., Canziani, O.F., Palutikof, J.P., Van Der Linden, P.J. and Hanson, C.E. (Eds.). *Climate Change 2007*, *Contribution of Working Group II contribution to Intergovernmental panel on climate change Fourth Assessment Report,* pp. 23.

Kaur, P., & Hundal, S.S. (2010). Global climate change vis-à-vis crop productivity. In M.K. Jha (Ed.) *Natural and anthropogenic disasters-Vulnerability, preparedness and mitigation*(pp. 413-431).New Delhi and Springer, The Netherlands: Capital Publishing Company.

Reynolds, M.P., Hobbs P., Ortiz R., Pietragalla J., & Braun H.J. (2008). International wheat improvement: Highlights from an expert symposium. In *International Symposium on Wheat Yield Potential: Challenges to International Wheat Breeding*, Mexico, D.F.: CIMMYT.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 155-159
DOI: 10.5958/2322-0430.2018.00051.3

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Economics of Resource Use of Greengram Production in Maharashtra

U.S. Bondar, V.D. Waiwal, and A.V. Gavali*

Department of Agricultural Economics, Mahatma Phule Krishi Vidyapeeth, Rahuri Dist. Ahmednagar

Corresponding author's email: bondarumarao@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-124* *Revision Accepted: March 07, 2018*

ABSTRACT

The data were related to greengram output and inputs collected from office record of State Cost of Cultivation Scheme, Government of Maharashtra, during the year 2013-14. The total sample size was 138. The simple statistical tools and the Cobb Douglas production function was fitted to the data. The results in respect of productivity all seven have jointly explained 74 percent of the total variation in the output of greengram, The resource use efficiency in greengram production in Maharashtra state was observed that the ratios of MVP to MC was positive and more than unity.

Keywords

Cobb-Douglas production function, Greengram, MVP to MC, resource use efficiency, resource use productivity.

JEL Codes

D57, J24, O47, P34, Q15.

INTRODUCTION

India is the largest producer and consumer of pulses in the world. Major pulses grown in India are Chickpea, Pigeon pea, Greengram, Black gram,and Lentil. Among various pulse crops, for the triennium ending 2012-13, the total area under pulses was 23.90 million hectare. India's population would reach 1.68 billion by 2030 from the present level of 1.21 billion. Accordingly, the projected pulse requirement for the year 2030 is 32 million tons with an anticipated required growth rate of 4.2% (IIPR Vision 2030). India has to produce not only enough pulses but also remain competitive to protect the indigenous pulse production. In view of this, India has to develop and adopt more efficient crop production technologies along with favourable policies to encourage farmers to bring more area under pulses. Asmatoddin *et al.* (2009) The results revealed that, greengram, area was positive and significant at onepercent level, the sum of elasticity was 1.01 percent which indicated increasing return to scale, coefficient of multiple determination was 0.86 which indicated that 86 percent variation in explanatory variable. More *et al*. (2015) examine the economics of production of greengram in Parbhani district of Maharashtra. The proportion of Cost 'A' in total cost was 51.33 percent, while proportion Cost B was 91.28 percent and output-input ratio was 2.24 indicating that greengram is profitable enterprise. Narayan *et al.* (2015) analyzed the pattern and sources of growth in pulses production in India. The study has observed an increasing trend in pulses production, driven mainly by yield improvements.

In Maharashtra state, greengram is cultivated in 6.71 lakh hectare with production 3.71 lakh tonnes. Its productivity is 552.91 kg/ha. The reasons for low productivity are low inputs usage. In greengram production process, some of the resources either are underutilization or overutilization. There is need to know optimum resource use for maximum profit in greengram production. Keeping in view the above aspects, the present study has been undertaken with specific objective to study the resource use structure, productivity and efficiency of greengram in Maharashtra.

METHODOLOGY

The study is based on the secondary data collected from the 138 farm families under the Scheme for Creating Permanent Machinery Studying the Cost of Cultivation of Principal Crops in Maharashtra. The data pertained to the agricultural year 2013-2014. The sample recorded from Western Maharashtra (73), Marathwada (35) and Vidarbha (30) for further analysis. The samples are not available for greengram in Konkan regions of

Maharashtra, In the present investigation, the data was compiled and analyzed, with simple statistical tools such as arithmetic mean average, percentage, and ratios were used. Costs are calculated as per the standard format of cost of cultivation i.e. Cost-A, Cost-B and Cost-C.

Functional Analysis

Cobb Douglas production function was used for estimating factors influencing the productivity of pulses.

$$Y \quad aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7} e^u$$

Where,

Y = Output of main produce (q ha^{-1})

a = Intercept.

X1 = Human labour (man days ha^{-1})

X2 = Bullock power (pairs days ha^{-1})

X3 = Machine power (hr ha^{-1})

X4 = Manure (q ha^{-1})

X5 = Nitrogen (kg ha^{-1})

X6 = Phosphorus (kg ha^{-1})

X7 = Potassium (kg ha^{-1})

u = Error term

bi´s = Regression coefficients of respective variables

Estimation of Marginal Value Product

The marginal value products (MVPs) of the individual resources were estimated and compared with the marginal cost (MC). The MVP of resources were estimated by using the following formula,

$$\textit{Marginal value product (MVP) of } X_i \quad b_i \frac{\bar{Y}}{\bar{X}} P_y$$

Where,

bi = Elasticity of production of ith input

Y = Geometric mean of output

Xi = Geometric mean of ith input

Py = Per unit price of output (₹)

RESULTS AND DISCUSSION

Per hectare Resource Use Structure for Greengram

The information on utilization of different resource for greengram is presented in Table 1 on per hectare basis.

The results indicated that at state level, the per hectare use of human labour bullock labour, and machine power utilization level was 52.45 man days, comprising 17.81 male and 34.54 female labour days, 4.88 pair days and 3.64 hr. It is concluded from above fact that irrespective of region, use of labour was more or less same on region and state level of greengram grower. The per hectare utilization of machine power was observed more (4.15 hr) in the case of Vidarbha region as compared to Marathwada (3.62 hr) and Western Maharashtra (3.23).

On an average at state level, the utilization of seed was 14.33 kgper hectare. The utilization of seed per hectare was observed more or less same irrespective of region. The use of manures at state level was 3.82 q/ha. The per hectare manure utilization by Western Maharashtra, Marathwada and Vidarbha region of greengram grower were 3.16, 8.27, and 2.61 quintals respectively, It is less than the recommended dose 50 q/ha. due to the non-availability and increasing cost of manures. At the state level, per hectare use of chemical fertilizers nitrogen, phosphorus and potassium was 18.46, 23.38 and 5.20 kg/ha, respectively. The plant protection charges incurred were □179.63 per ha for greengram. The per hectare plant protection charges was observed very less in the case of all region and state because of farmer purpose in that crop was subsistence crop and crop rotations.

Resource Use Productivities in Production of Greengram

Cobb-Douglas production function were used for estimating resource use productivities in greengram production on the basis of goodness of fit (R^2) which

Table 1. Resource use structure for green gram in Maharashtra

(Per ha)

Resources	Unit	Region			Maharashtra
		Western Maharashtra	Marathwada	Vidarbha	
Total human labour	Mandays	52.48	52.99	53.04	52.35
a. Male		17.54	18.25	18.17	17.81
b. Female		34.94	34.74	34.87	34.54
Bullock Power	Pair days	5.70	5.31	3.65	4.88
Machine Power	hr	3.23	3.62	4.15	3.64
Seed	kg	14.97	14.34	13.52	14.33
Manures	q	3.16	8.27	2.61	3.82
Total Fertilizers	kg	35.65	73.70	49.08	47.04
N		16.07	20.93	20.31	18.46
P		13.67	45.16	25.57	23.38
K		5.91	7.61	3.20	5.20
Plant protection charges	(₹)	36.12	00.00	440.83	179.63

indicates the proportion of total variation of the dependent variable jointly explained by the independent variables.

The results of resource use productivities for greengram production in different region of Maharashtra are presented in the Table 2. The results revealed that the seven resource variables viz; human labour (X_1), bullocklabour (X_2), machine power (X_3), manure (X_4), nitrogen (X_5), phosphorus (X_6) and potash (X_7) were included in the production function analysis of greengram.

The analysis showed that these variables have jointly explained about 78 percent variation in the yield of greengram in Western Maharashtra. The regression coefficients of human labour (X_1), manures (X_4), phosphorus (X_6) and potash (X_7) were turned out to be positive and significant indicating thereby that, one unit increase in the use of these variables would increase the yield by 0.4857, 0.2411, 0.0983 and 0.0583 percent, respectively. However, bullock labour, machine power,and nitrogen were not significant but positive, it indicate that they have positive impact on output.

In Marathwada, the value of Coefficient of Multiple Determination (R^2) was 0.73 which indicated that 73 percent variation in greengram production was explained due to variation in all independent variables. Therefore, it can be concludes that each explanatory variable on its own was very important but together they explained significantly part of variation in greengram production. Further, regression coefficients with respect to human labour (X_1), manure (X_4), nitrogen (X_5) and potash (X_7) were 0.3882, 0.2349, 0.3496 and0.2996 which were positive and significant at 5 percent level and indicated that, when we increase the use of these variables by 5 percent over their geometric mean, would lead to increase greengram production by 0.3882, 0.2349, 0.3496, and 0.2996 percent respectively, while regression coefficients with respect to bullock power (X_2) and phosphorus (X_6) were 0.0363 and 0.0257 which were positive but not significant indicated that, it indicate that they have positive impact on output.

The estimated parameters of human labour (X_1), manure (X_4), nitrogen (X_5) and potash (X_7) were significant in Vidarbha, it indicating that for every one percent increase in the expenditure on these resources would result in increased gross return by 0.4269, 0.2461, 0.2802, and 0.0394 percent respectively. The value of Coefficient of Multiple Determination (R^2) was found to be 0.71 which indicate that 71 percent variation in output was jointly explained by seven independent resource variables under consideration.

At the state level, Coefficient of Multiple Determination(R^2) turned out to be to be 0.74 indicating that 74 percent variation in output is jointly explained by the above considered independent factors. The regression coefficient of variables human labour (X_1), bullock labour (X_2), manure (X_4), nitrogen (X_5) and potash (X_7) were statistically significant. This indicated that one unit

Table 2. Result of Cobb-Douglas production function for greengram in Maharashtra

Particular	Region			Maharashtra
	Western Maharashtra	Marathwada	Vidarbha	
Intercept (a)	0.4149	0.2777	0.1839	0.3991
Human labour (days/ha) (X_1)	0.4857^{***} (0.1139)	0.3882^{**} (0.1429)	0.4269^{*} (0.2172)	0.3818^{**} (0.1439)
Bullock power (Pair days/ha) (X_2)	0.0721^{NS} (0.0579)	0.0363^{NS} (0.1236)	0.0262^{NS} (0.1260)	0.0072^{*} (0.0043)
Machine power (hr/ha) (X_3)	0.0126^{NS} (0.0308)	0.1661^{NS} (0.3217)	0.0091^{NS} (0.0119)	0.0012 (0.0028)
Manures (q/ha) (X_4)	0.2411^{**} (0.1028)	0.2349^{**} (0.1123)	0.2461^{**} (0.1123)	0.2132^{**} (0.1024)
Nitrogen (kg/ha) (X_5)	0.0129^{NS} (0.0614)	0.3496^{**} (0.1347)	0.2802^{**} (0.1132)	0.3216^{***} (0.1238)
Phosphorus (kg/ha) (X_6)	0.0983^{***} (0.0260)	0.0257^{NS} (0.0267)	0.0147^{NS} (0.2109)	0.0168^{NS} (0.3588)
Potash (kg/ha) (X_7)	0.0583^{**} (0.0250)	0.2996^{**} (0.1232)	0.0394^{***} (0.0122)	0.0716^{***} (0.0246)
R^2	0.78	0.73	0.71	0.74
Number of observation	73	35	30	138
Degree of freedom	65	27	22	130

Figures in parentheses are standard errors of respective regression coefficient.
****, **, and *** indicates significance at 10, 5 and 1 percent level respectively.***
NS: Non-significant.

increase in the human labour (X_1), bullock labour (X_2), manure (X_4), nitrogen (X_5) and potash (X_7) would result into 0.3818, 0.0072, 0.2132, 0.3216 and 0.0716 percent increase in the output respectively.

Resource Use Efficiency in Greengram Production

The resource use efficiency in greengram production on the sample farms in the different region and state was judged with the help of MVP/MC ratio and the results of resource use efficiency are presented in Table 3.

The resource use efficiency in greengram production in Western Maharashtra region was observedthat the ratios of MVP to MC was positive and more than unity for human labour, manures, phosphorus,and potash, indicating that, these resources were used advantageously and there was greater chance to increase the use of these resource. When MVP to price ratio tends to unity at that point, there would be efficient utilization of resource. Whereas, it was lower than one in case of bullock labour and nitrogen, indicating overutilization of these inputs in greengram cultivation.

In Marathwada region, resource use efficiency in production of greengram is noticed that marginal value product to factor cost ratio (MVP/MC) was greater than unity in case of human labour, manures, nitrogen, and potash. This implied that higher resource use efficiency was achieved in case of these variables. The MVP/MC ratio for bullock labour and phosphorus was found to be less than unity suggesting the inefficient use of these resources.

Vidarbha revealed that (MVP/MC) was greater than unity in case of human labour, manure, nitrogen, and potash. This means these variables were underutilized and there is scope for increasing inputs utilization whereas others are excessively used. In the case of state level farmer category, the MVP/MC ratio is showing above 1 for human labour , manure, nitrogen, and potash indicating less use, which could help to increase production up to maximum level by their optimum utilization. Hence needs to train the farmers regarding use of different inputs in a manner to optimize yield.

CONCLUSIONS

Result indicated that at state level, the per hectare use of human, bullock, machine power, and seed utilization indicated that irrespective of region, use of these resources was more or less same on region and state level of greengram grower. The per hectare manure utilization is less than the recommended dose 50 q/ha due to the non-availability and increasing cost of manures. In case of

Table 3. Resource use efficiency in production of greengram in different region of Maharashtra

Particular	Units	GM X	GM Y	Py	bi's	MPP	MVP	MC	MVP/MC
Western Maharashtra									
Total human labour	Man days	52.48	5.07	4918.85	0.4857	0.0469	230.81	183.42	1.2584
Total bullock labour	Pair days	5.60	5.07	4918.85	0.0721	0.0653	321.19	650.00	0.4941
Manures	q	3.16	5.07	4918.85	0.2411	0.3868	1902.80	150.00	12.6853
N	kg	16.07	5.07	4918.85	0.0129	0.0041	20.06	29.44	0.6813
P	kg	13.67	5.07	4918.85	0.0983	0.0365	179.33	45.98	3.9002
K	kg	5.91	5.07	4918.85	0.0583	0.0499	245.69	20.29	12.1089
Marathwada									
Total human labour	Man days	50.40	7.10	3802.40	0.3882	0.0547	207.94	184.45	1.1274
Total bullock labour	Pair days	4.15	7.10	3802.40	0.0363	0.0620	235.87	450.00	0.5241
Manures	q	7.12	7.10	3802.40	0.2349	0.2342	890.50	150.00	5.9366
N	kg	18.13	7.10	3802.40	0.3496	0.1369	520.58	36.17	14.3927
P	kg	40.16	7.10	3802.40	0.0257	0.0045	17.28	37.63	0.4591
K	kg	6.20	7.10	3802.40	0.2996	0.3431	1304.51	19.60	66.5565
Vidarbha									
Total human labour	Man days	51.14	6.50	4042.00	0.4269	0.0543	219.31	184.39	1.1868
Total bullock labour	Pair days	2.80	6.50	4042.00	0.0262	0.0609	246.07	550.00	0.4474
Manures	q	2.60	6.50	4042.00	0.2461	0.6154	2487.31	150.00	16.5821
N	kg	19.31	6.50	4042.00	0.2802	0.0943	381.30	26.04	14.6430
P	kg	23.52	6.50	4042.00	0.0147	0.0041	16.44	41.53	0.3959
K	kg	3.20	6.50	4042.00	0.0394	0.0801	323.79	18.65	17.3615
Maharashtra									
Total human labour	Man days	49.30	6.41	4038.75	0.3818	0.0496	200.47	185.60	1.0801
Total bullock labour	Pair days	4.12	6.41	4038.75	0.0072	0.0112	45.13	585.13	0.0771
Manures	q	3.70	6.41	4038.75	0.2132	0.3693	1491.42	149.91	9.9488
N	kg	18.46	6.41	4038.75	0.3216	0.1117	451.13	29.34	15.3760
P	kg	23.38	6.41	4038.75	0.0168	0.0046	18.58	41.47	0.4481
K	kg	5.20	6.41	4038.75	0.0716	0.0883	356.64	19.72	180.052

resource use productivities in greengram cultivation for state level, it was observed that all seven variable viz., human labour, bullock power, machine power, manures, nitrogen, phosphorus and potash included in the production function analysis have jointly explained 74 percent of the total variation in the output of greengram. At state level, resource use efficiency in production of greengram is noticed that marginal value product to factor cost ratio was greater than unity in case of human labour, manures, nitrogen, and potash. This implied that higher resource use efficiency was achieved in case of these variables. Hence need to train the farmer regarding use of different inputs in a manner to optimize yield.

REFERENCES

Asmatoddin, M.S., Jawale, V., Ghulghule, J.N., & Tawale, J. B. (2009). Resource productivity and resource use efficiency in pulses production on medium farm in Marathwada. *International Journal of Agricultural Science, 5*(2), 359-362.

More, M.S., Katkade, J.L., & Chavan, R.V. (2015). Economics of production of greengram in Parbhani district. *Maharashtra Journal of Agricultural Economics*, *19*(1): 124.

Narayan, S.R., Kumar, S., Singh, D.R., Chahal, V.P., & Shaloo, R.V. (2015). Sources of growth in pulses production in India. *Agricultural Economics Research Review*, *28*(1), 91-102.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 160-167
DOI: 10.5958/2322-0430.2018.00052.5

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Comparative Spatio-temporal Analysis of Land Use Pattern in India and Gujarat[#]

A.J. Amale[1], R.L. Shiyani[2], N.J. Ardeshna[3] and B. Swaminathan[4]*

[1]*Ph.D. Scholar, JAU, Junagadh, and Junior Research Assistant, Department of Agricultural Economics, MPKV, Rahuri*
[2]*Professor,* [3]*Associate Research Scientist, and* [4]*Assistant Research Scientist Department of Agricultural Economics Junagadh Agriculture University, Junagadh, Gujarat*

[*]*Corresponding author's email: amaleaj@rediffmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-140* *Revision Accepted: March 10, 2018*

ABSTRACT

An analysis of structural changes in the land use pattern over a period of time provides scope for planned and judicious management of land. Keeping this in view, an attempt is made in this study to analyze the temporal and spatial changes in land use categories. The present study was based on the secondary data on land use for the period from 1970-71 to 2014-15, collected from various published sources. The results envisaged that the increase in the net area sown was observed at Gujarat state as well as at aggregate level of India, but the increase in case of Gujarat was as high as 4.66 percent while it was only 0.28 percent at national level. Markov chain analysis revealed that at the national level, during Overall Period, net area sown was a major gainer among the different land use categories with the gain of 48.10, 25.20 and 12.20 percent from fallow land, land not available for cultivation and other uncultivable land excluding fallow land, respectively. In Gujarat state also, during all the three periods, net area sown was a major gainer among the different land use categories with the gain of 53.00, 20.90 and 19.20 percent from fallow land, land not available for cultivation and forest, respectively. The projected land use dynamics of Gujarat implying that the land use categories viz; forest, land not available for cultivation and other uncultivable land except fallow land are likely to lose their area in coming years whereas the net area sown is likely to remain same or very marginally increase in the future in Gujarat state as a whole.

Keywords
Fallow land, land use, Markov chain, net area sown, spatio-temporal changes.

JEL Codes
C23, Q15, Q24, R14.

INTRODUCTION

Land and water are the crucial natural resources for any development activity. Consequently, access to land and control over its uses were the prime sources of conflict within and between communities throughout human history. Like any other resource, land has two dimensions, *viz*; quality and quantity, and both of these crucial aspects are under serious threat due to the intensive and extensive use of land for agricultural as well as non-agricultural purposes. Though technological progress in agriculture and agricultural intensification have mitigated the ever-increasing demand for land for food production, burgeoning population and the consequent demand for land for non-agricultural purposes are posing a serious challenge to both researchers and policymakers.

The challenge of natural resources management is evident from the fact that with a mere 2.4 percent share of the world's land and only 4.0 percent share of the world's freshwater resources, the agricultural sector of India has to cater to 17.5 percent of the world's population. In 2011, India's population reached 121 crores, which is about 17 percent of the world population while net sown area was about 140.13 million ha in 2014-15 and about 0.12 hectare per capita, and less than half of the world average of 0.23 hectare (Directorate of Economics and Statistics,

[#]***This paper has been developed from an yet to be submitted Ph.D. thesis of the first author to the Junagadh Agriculture University, Gujarat***

2016). This problem of limited availability of land has been compounded by growth in population, urbanisation and diversion of productive agricultural land for non-agricultural purposes. During the last two decades, India's population has increased by about 18.4 crores, while the total agricultural land has decreased by about 3.2 million hectares (Sharma, 2015).

METHODOLOGY

The present study was based on the secondary data on land use for the period from 1970-71 to 2014-15, collected from various published sources *viz*; Land Use Statistics at a Glance published by the Directorate of Economics and Statistics, New Delhi and various issues of Statistical Abstract of Gujarat State, Handbook of Basic Statistics Gujarat State published by the Directorate of Economics and Statistics (DES), Government of Gujarat, Gandhinagar. The entire period of 1970-71 to 2014-15 was decomposed into three periods, *viz*; Pre-liberalization, Post- liberalization and Overall Period. A temporal change in land use pattern was estimated with the simple tabular method. Markov chain analysis was employed to examine the nature and extent of land use shift between major land use categories.

Markov Chain Analysis

The Markov process was used to study the shifts in the shares of land use categories thereby gain an understanding about the dynamics of the changes in land use (Singh, 2012; Adhikari & Sekhon, 2014; Kumar *et al*., 2014; Tirlapur & Mundinamani, 2015).

Markov Probability Model

Any sequence of trials (experiments) that can be subjected to probabilistic analysis is called a stochastic process. For a stochastic process, it is assumed that the movements (transitions) of objects from one state (possible outcome) to another are governed by a probabilistic mechanism or system. A finite Markov process is a stochastic process whereby the outcome of a given trial t (t=1, 2…… r) depends only on the outcome of the preceding trial (t-1) and this dependence is the same at all stage in the sequence of trials. Consistent with this definition, Let,

S_i = be the ith state of r possible outcomes; i=1, 2, ……, r

W_{it} = be the probability that state S_i occurs on trial t or the proportion observed in trial t in alternate outcome state I of the multinomial population based on a sample of size n, *i.e.* Pr (S_{it}).

P_{ij} = Represents the transitional probability which denotes the probability that if for any time t the process is in state S_i, it moves onto next trial to state S_j, *i.e.,* Pr $(S_{j \cdot t+1}/S_{jt}) = P_{ij}$

P = (P_{ij}) = Represents the transitional probability matrix which denotes the transitional probability for every pair of states (i, j=1,2……r), and has the following properties.

$0 < P_{ij} < 1$,……(1)

and

$\sum_j P_{ij} = 1, 2, ...r.....(2)$

Given this set of notations and definitions for a first-order Markov chain, the probability of a particular sequence S_i on trial t and S_j on trial t+1 may be represented by

$P_r\ (S_{it},\ S_{j.t+1}) = P_r(S_{it})\ P_r(S_{j.t+1}\ /S_{it}) = W_{it}P_{ij}$. …… (3)

and the probability of being in state j at trial t+1 may be represented by,

$P_r(S_{j.t+1})\ \sum_j W_{it} = P_j$ or $W_{j,\,t+1} = \sum_j W_{it}P_{ij}$ …… (4)

The data for the study are the proportions of area under land use. The proportions change from year to year as a result of different factors. It is reasonable to assume that the combined influence of these individually systematic forces approximates a stochastic process and the propensity of farmers to move from one land use category to another category differs according to the land use category involved. If these assumptions are acceptable, then the process of land use dynamics may describe in the form of a matrix P of first order transition probabilities. The element P_{ij} of the matrix indicates the probability of land use category i in one period will move to land use category j during the following period. The diagonal element P_{ij} measures the probability that the proportionate share of ith category of land use will be retained.

The transition probability matrix was estimated using the Minimum Absolute Deviation (MAD) estimator. The elements P_{ij} of the matrix are the conditional probabilities of the area under a particular land use category in time t given its share in time t-1. The diagonal elements P_{ij} (i=j) indicate the extent of stability of land use categories. Hence, as the diagonal elements approach zero, area under a particular land use become less and less stable, and as they approach one, the land use categories tend to exhibit more and more stability over time. The off-diagonal elements P_{ij} ($i \neq j$) are the probabilities of switching over between different land use categories. If $P_{ij}$is the diagonal element corresponding to the ith land use category, the other elements in the ith row give the proportions of previous period's area of ith land use category to other categories in the current period. The elements of the ith column gives the proportions of areas gained by i^{th} land use category from other land use categories.

Estimation of Transition Probability Matrix

Equation (3) can be used as a base for specifying the statistical model for estimating the transition probabilities. If errors are incorporated in equation (3) to account for the difference between the actual and estimated occurrence of $W_{j(t+1),}$ the sample observations may be assumed to be generated by the following linear statistical model:

$W_{jt} = \sum_j W_{it-1}P_{ij} + U_{jt}$ …….. (5)

or in matrix form, it can be written as,

$Y_j = X_j P_j + U_j$…… (6)

Where, Y_j is a (Tx1) vector of observations reflecting the proportion in land use pattern in time t, X_j is a (Txr) matrix of realized values of the proportion in land use pattern in time t-1, P_j is a (rx1) vector of unknown transition parameters to be estimated and U_j is a vector of random disturbances.

The Minimum Absolute Deviations Estimator

A method to derive parameter estimates when equality or inequality restrictions are present is to make use of Minimum Absolute Deviations (MAD) estimator. If we employ this method in obtaining estimates of the transition probabilities, our problem may be specified as follows:

To find a vector P, this minimizes

$Y\text{-}XP|'E$…… (7)

Subject to:

$Y = XP + u$; ……..... (8)

$RP = e$; …..…… (9)

$P \geq 0$……..... (10)

Where E is a unit vector of order (rTx1). In order to solve the above LP problem, non-negative variables are introduced for u such that

$U = \theta\text{-}p$……. (11)

Where,

$\theta = [\theta_{jt}] = [\theta_{11}, \theta_{12} \ldots\ldots\ldots \theta_{1T}, \theta_{21} \ldots\ldots \theta_{rT}]' \geq 0$. ….(12)

and

$p = [p_{jt}] = [p_{11}, p_{12}, \ldots\ldots\ldots p_{1T}, p_{21}, \ldots\ldots p_{rT}]' \geq 0$… (13)

By redefining u in this way, the Linear Programming (LP) problem may be transformed to the following form.

To minimize:

$(\theta + p)'E$ ……..... (14)

Subject to:

$Y = XP + u = XP = [1,\text{-}1] - (\theta/P\_\ldots$ (15)

$RP = e$ and …… (16)

$P, \theta, p >$…… (17)

Projections

After estimating transition probability matrix (P), proportion of area under land use categories was predicted using the following equation:

$Y'_{(t)} = Y'_{(0)} P^t$ ……..…. (18)

Where,

Y_t= (r x 1) vector of proportion of area under land use categories in year t;

Y_0 = (r x 1) vector of proportion of area under land use categories in year 0;

P^t = (r x r) transition probability matrix to the power of time (t) and $Y'_{(t)}$ and $Y'_{(0)}$ are transpose of vector $Y_{(t)}$ and $Y_{(0)}$, respectively.

RESULTS AND DISCUSSION

Temporal Changes in Land Use Pattern

Substantial changes in land use pattern have taken place during the study period, mainly driven by biophysical factors and human needs. In this study, the changes in land use pattern at All India level and Gujarat state as a whole are given. The changes in land use pattern between Pre-liberalization period and Post-liberalization period were calculated and the results are presented in Table 1.

Comparative Change in Different Land Use Categories in Gujarat and India

The average land use pattern for Gujarat state as a whole and India was worked out for the Pre-liberalization period (Period-I) from 1970-71 to 1990-91 and Post-liberalization period (Period-II) from 1991-92 to 2014-15, along with the changes in land use pattern between the two periods and the same is presented in Table 1.

It can be inferred from Table 1, that at the All India level, land put to non-agricultural use, fallow other than current fallow, area under forest, current fallow and net area sown in the country have increased by 25.96, 9.88, 5.32, 3.95 and 0.28 percent, respectively during Period-II over Period-I; while barren and un-culturable land, cultivable waste, permanent pastures & other grazing and land under miscellaneous tree crops & groves have declined by 18.41, 18.19, 12.86 and 8.20 percent, respectively. For Gujarat state as whole, land put to non-agricultural use, net area sown and area under forest have increased by 8.43, 4.66 and 0.32 percent, respectively during Period-II, but fallow other than current fallow, current fallow, land under miscellaneous tree crops & groves, cultivable waste, barren and un-culturable land and permanent pastures & other grazing have declined by 91.46, 20.60, 20.34, 1.82, 1.51 and 0.48 percent, respectively during the same period. A perusal of comparison between India and Gujarat state clearly indicates that during both the periods, the share of forest in Gujarat state was lower than the share of forest to the total reporting area at national level. Similar results were found by Bardhan & Tewari (2010). They concluded that the states having the lowest forest cover are Haryana, Punjab, Rajasthan, and Gujarat.

The results revealed that the area under forest has been increased by 5.32 percent at the national level while it increased by 0.32 percent in Gujarat state during Period-II over the Period-I. At All India level, the share of barren and un-culturable lands has declined from 7.10 percent of total reporting area in Period-I to 5.57 percent in Period-II, while in case of Gujarat state, it slightly declined from 13.95 to 13.69 percent of total reporting area in the same period. At aggregate level of India, area under non-agricultural uses has increased by 25.96 percent while it has increased by 8.43 percent in case of Gujarat between these two periods, implying thereby almost three times more increase in India compared to that of Gujarat. Sharma (2015) also concluded from his study that the loss of prime agricultural land to non-agricultural uses has been intensifying in the country but varied across different states. The area under non-agricultural uses in India increased by about 23 percent (21.3 million ha to 26.3 million ha) during the last two decades. The states like Uttar Pradesh, Andhra Pradesh, Odisha, Madhya

Pradesh, Bihar and Tamil Nadu showed relatively higher rate of increase while Gujarat and few North-Eastern States showed the lower rate of increase in land under non-agricultural uses during the last two decades. However, the trend for almost all the states is increasing. This is an alarming situation which should be taken into consideration by the policy makers in order to achieve the target of doubling the farmers' income by 2022.

Permanent pastures and other grazing lands have declined by 12.86 percent at national level which indicates gradual conversion of permanent pastures and other grazing lands. In Gujarat state also, it has declined but it is marginal as compared to national level. Similar results were also found by Ashrit (2014), in which he concluded that land usage under permanent pastures and other grazing lands showed a declining trend by 9.7 percent at All India level, with Kerala, Bihar, Madhya Pradesh, Uttar Pradesh and Punjab by 91.9, 76.8, 73.6, 73.6 and 64.2 percent, respectively during the period 1950-51 to 2010-11. A declining trend in permanent pastures and other grazing land will have an adverse impact on livestock sector and milk production.

The area under cultivable waste declined by 18.19 percent in India during the Period-II over the Period-I while a decline was only 1.82 percent at the Gujarat state as a whole. Similar results were found by Sharma (2015). He observed that in India, area under cultivable waste declined by 17.96 percent during the 2011-12 over 1991-92.

At the All India level, area under current fallow as well as fallow other than current fallow increased by 3.95 and 9.88 percent during Period-II over Period-I. Ramasamy *et al.* (2005) pointed out that, several factors are responsible for the increase in fallow lands. One of the

Table 1.Comparative changes in different land use categories in Gujarat and India

(Area in '00' hectares)

Land use category	Gujarat			India		
	Average of Period-I (1970-1990)	Average of Period-II (1991-2014)	Percent change	Average of Period-I (1970-1990)	Average of Period-II (1991-2014)	Percent change
Forest	18490.14 (9.82)	18548.94 (9.82)	0.32	666035.67 (21.88)	701454.74 (22.92)	5.32
Barren and uncultivable land	26256.67 (13.95)	25861.38 (13.69)	-1.51	216266.48 (7.10)	176443.98 (5.77)	-18.41
Land put to non-agricultural use	10604.29 (5.63)	11498.25 (6.08)	8.43	193766.57 (6.37)	244066.48 (7.98)	25.96
Permanent pastures and other grazing	8542.24 (4.54)	8501.52 (4.50)	-0.48	121834.52 (4.00)	106166.00 (3.47)	-12.86
Land under miscellaneous tree crops & groves	48.33 (0.03)	38.50 (0.02)	-20.34	37595.90 (1.24)	34513.35 (1.13)	-8.20
Cultivable waste	20088.90 (10.67)	19723.04 (10.44)	-1.82	164642.05 (5.41)	134699.40 (4.40)	-18.19
Current fallow	8193.57 (4.35)	6505.60 (3.44)	-20.60	142824.43 (4.69)	148460.50 (4.85)	3.95
Fallow other than current fallow	2271.62 (1.21)	194.06 (0.10)	-91.46	95380.62 (3.13)	104799.59 (3.42)	9.88
Net area sown	93735.33 (49.80)	98105.40 (51.91)	4.66	1405665.05 (46.18)	1409589.54 (46.06)	0.28
Total reporting area	188231.09 (100.00)	188976.69 (100.00)	0.40	3044011.29 (100.00)	3060193.58 (100.00)	0.53
Area sown more than once	10292.05 (5.47)	16057.76 (8.50)	56.02	325932.86 (10.71)	494332.48 (16.15)	51.67
Total cropped area	104099.24 (55.30)	114187.28 (60.42)	9.69	1731597.90 (56.89)	1903922.02 (62.22)	9.95
Net irrigated area	18638.71 (9.90)	34659.83 (18.34)	85.96	388484.29 (12.76)	587509.87 (19.20)	51.23
Gross irrigated area	21819.38 (11.59)	44006.18 (23.29)	101.68	496118.43 (16.30)	807199.97 (26.38)	62.70

Figures in parentheses indicate percent share to the total reporting area.

major factors is rainfall, which affects the net sown area thus having a direct bearing on the area under current fallow as well as other fallow. A continuous failure of monsoons and even the delayed onset of monsoons may lead to increase in other fallows. On the other hand, area under current fallow and other fallow registered a decline of 20.60 and 91.46 percent, respectively in Gujarat during the same period, indicating a better sign than the situation at All India level, for the same land use category. Ashrit (2014) also found that though at country level, the area under current fallow increased by 3.10 percent, it decreased in Gujarat by 3.50 percent during period of 1990-91 to 2010-11.

The increase in the net area sown was observed at Gujarat state as well as at aggregate level of India, but Gujarat recorded 4.66 percent of increase while it was only 0.28 percent increase at national level. Swain *et al.* (2012) also recorded the same trend. They concluded that during the last two decades, net area sown has grown from 93 lakh hectares (1990-91) to 103 lakh hectares (2009-10) in Gujarat. Area sown more than once and total cropped area increased by 51.67 and 9.95 percent, at country level and 56.02 and 9.69 percent, at Gujarat state particularly during the aforesaid period. Net irrigated area increased by 51.23 and 85.96 percent at All India level and Gujarat state, respectively in the same period. Notable results of the comparative analysis of change in gross irrigated area at India and Gujarat is that it increased by 62.70 percent at country level, while 101.68 percent in Gujarat state during Period-II over the Period-I. Similar trend was noticed by the different researchers in different states (Singh, 2012; Musande, 2014; Ashrit, 2014; Ramasamy *et al.*, 2005; Mouzam *et al.*, 2015; Sharma, 2015).

Nature and Extent of Structural Variation in Land Use Pattern

This section elucidated the land use shift from one land use category to another. First order Markov chain approach was separately employed for analyzing the land use shift at national and state level for all the three periods under study. Figures in the diagonal elements of the transitional probability matrix (TPM) are the retention of concerned land use category which is the proportion of its share from last year that is retained in current year. Row indicates lost to another land use category and column shows gain from each land use category. The sum of probability across rows leads to 1 because what is not retained must be lost.

Nature and Extent of Structural Variation in Land Use Pattern in India

The Markov chain analysis was carried out for three periods (*i.e.* Period-I: 1970-71 to 1990-91, Period-II: 1991-92 to 2014-15 and Overall: 1970-71 to 2014-15) to analyze the shift in land use pattern in India. The stability of the area share of the different land use categories and

Table 2. Transitional probability matrix for land use categories in India

Land use category	Period-I: 1970-71 to 1990-91				
	Forest	Land not available for cultivation	Other uncultivable land excluding fallow	Fallow land	Net area sown
Forest	0.246	0.000	0.000	0.317	0.437
Land not available for cultivation	0.000	0.288	0.020	0.000	0.692
Other uncultivable land excluding fallow	0.119	0.000	0.881	0.000	0.000
Fallow land	0.198	0.169	0.000	0.100	0.533
Net area sown	0.300	0.177	0.017	0.000	0.506
Period-II: 1991-92 to 2014-15					
Forest	0.672	0.106	0.000	0.222	0.000
Land not available for cultivation	0.133	0.775	0.000	0.091	0.000
Other uncultivable land excluding fallow	0.000	0.000	0.840	0.000	0.160
Fallow land	0.125	0.065	0.004	0.141	0.665
Net area sown	0.104	0.005	0.027	0.016	0.849
Overall: 1970-71 to 2014-15					
Forest	0.621	0.106	0.000	0.273	0.000
Land not available for cultivation	0.286	0.462	0.000	0.000	0.252
Other uncultivable land excluding fallow	0.000	0.000	0.878	0.000	0.122
Fallow land	0.168	0.222	0.000	0.129	0.481
Net area sown	0.074	0.067	0.021	0.019	0.818

1. Land not available for cultivation includes a) Land put to non-agricultural use .
b) Barren and uncultivable .
2. Other uncultivated land excluding fallow includes a) Permanent pastures and other grazing lands .
b) Cultivable waste .
3. Fallow lands include a) Current fallow b) Fallow other than current fallow .

the direction and volume of change over time was captured by transitional probability matrix and the results are presented in Table 2. It can be inferred that during the Period-I, all land use categories have shown stability. But the highest stability was acquired by other uncultivable land excluding fallow land as reflected in high probability of retention at 0.881, that is, the probability that other uncultivable land excluding fallow land retains its share from one period to another period is 88.10 percent. Net area sown retained 50.60 percent of its previous years' share; on the other hand, land not available for cultivation, forest and fallow land retained 28.80, 24.60 and 10.00 percent, respectively of its previous years' share in current year. The major gainer among the different land use categories during Period-I was net area sown which gained 43.70 percent from forest, 69.20 percent from land not available for cultivation and 53.30 percent from fallow land. Adhikari & Sekhon (2014) also found the similar results. They observed that the major gainer among the different land use categories during Period-I (1980-81 to1994-95) was net area sown which had a transfer probability of 0.325 from land not available for cultivation, 0.229 from other uncultivated land excluding fallow land and 0.340 from fallow land in Punjab. Accordingly, at the national level, fallow land was highly unstable and other uncultivable land excluding fallow land was highly stable during Period-I.

The results of TPM for Period-II inferred that at the national level, net area sown showed highest stability among all the land use categories with the retention of 84.90 percent of its previous years' share which was followed by other uncultivable land excluding fallow land, land not available for cultivation, forest area and fallow land with retention of 84.00, 77.50, 67.20 and 14.10 percent of its previous years' share, respectively. During the Period-II, as a major gainer among the different land use categories net area sown has gained 66.50 from fallow land and 16.00 percent from other uncultivable land excluding fallow land. At the All India level, fallow land recorded as highly unstable land use category during the Period-II which experienced the retention of 14.10 percent of its previous years' share in current year.

It is evident from the results of TPM for the Overall Period, that at the national level, other uncultivable land excluding fallow land was more stable among all the land use categories with the retention of 87.80 percent of its previous years' share. Net area sown retained 81.80 percent of its previous years' share. On the other hand, area under forest, land not available for cultivation and fallow land retained 62.10, 46.20 and 12.90 percent, respectively of its previous years' share during current year in India. As observed in all the periods, net area sown was a major gainer among the different land use categories with the gain of 48.10, 25.20 and 12.20 percent from fallow land, land not available for cultivation and other uncultivable land excluding fallow land, respectively. At the All India level, fallow land was recorded as highly unstable land use category during the entire period of study which experienced the retention of 12.90 percent of its previous years' share in current year.

As compared to Period-I, forest and land not available for cultivation showed an increase in the magnitude of retention of its previous years' share in current year during the Period-II, indicating that these land use categories are going towards stability during recent years in India. The notable observation recorded is that during all the periods, other uncultivable land excluding fallow land was highly stable and fallow land was highly unstable at the national level. Markedly increase in retention of net area sown was noticed during Period-II over the Period-I. This could be attributed to the gain to cultivable land from fallow lands indicating that with the advancement in technologies, most of the fallow land could be brought under cultivation which in turn resulted to check encroachment for development on agricultural land and provided for additional cultivable area.

It can be implied that in the years to come, there would be a very high pressure towards land put to non-agricultural uses due to increasing population demands. By and large, similar results were found by Harish (2006); Aravind (2010); Gairhe (2011); Adhikari & Sekhon (2014); Singh (2012); Tirlapur & Mundinamani (2015) for different study areas.

Nature and Extent of Structural Variation in Land Use Pattern in Gujarat

In order to analyze the shift in land use pattern of Gujarat state as a whole, the Markov chain analysis was separately used for three periods (Period-I: 1970-71 to 1990-91, Period-II: 1991-92 to 2014-15, Overall: 1970-71 to 2014-15). The stability of the area share of the different land use categories and direction & volume of change over time is captured by transitional probability matrix and the results are presented in Table 3.

It can be observed from the results that all land use categories have shown stability during the Period-I. But the highest stability was acquired by net area sown as reflected in high probability of retention at 0.902 *i.e.* the probability that net area sown at Gujarat state as whole retained its share from one period to another period was 90.20 percent. Land not available for cultivation retained 79.30 percent of its previous years' share. On the other hand, other uncultivable land excluding fallow land, forest, and fallow land retained 74.80, 50.90 and 14.00 percent of its previous years' share, respectively during current year. During the Period-I, the major gainer among different land use categories was net area sown which gained 70.40 percent from fallow land and 17.90 from forest at the state level in Gujarat. Accordingly, fallow land was highly unstable and other uncultivable land excluding fallow land was highly stable during Period-I in Gujarat.

The results of TPM for Period-II revealed that, for

Gujarat state as a whole, except the other uncultivable land excluding fallow land, all land use categories showed stability in their previous years' share. Net area sown showed highest stability among all the land use categories with the retention of 83.40 percent of its previous years' share, whereas fallow land, land not available for cultivation and forest retained the 67.80, 62.50 and 39.30 percent of its previous years' share, respectively. During the Period-II, as a major gainer among the different land use categories, net area sown has gained 60.30 percent from other uncultivable land excluding fallow land and 4.30 percent from fallow land. At Gujarat state as whole, other uncultivable land excluding fallow land was recorded as highly unstable land use category during Period-II, which did not retain its previous years' share in current year.

During Overall Period, for the Gujarat state as a whole, net area sown was highly stable among all the land use categories with the retention of 84.30 percent of its previous years' share. Land not available for cultivation retained 74.30 percent of its previous years' share. On the other hand, other uncultivable land excluding fallow land, forest and fallow land retained 55.40, 51.20 and 28.10 percent, respectively of its previous years' share in current year at state level in Gujarat during Overall Period. As observed in all the periods, net area sown was a major gainer among the different land use categories with the gain of 53.00, 20.90 and 19.20 percent from fallow land, land not available for cultivation and forest, respectively. For Gujarat state as a whole, fallow land recorded as highly unstable land use category during the Overall Period which experienced the retention of 14.10 percent of its previous years' share in current year. Similar results were found by Gairhe (2011); Adhikari& Sekhon (2014); Singh (2012); Tirlapur & Mundinamani (2015).

Except fallow land, all the land use categories showed lower retention of its own previous years' share in current year during Period-II over the Period-I, indicating inclination of these land use categories towards the instability in recent years. Decreasing magnitude of retention in forest and net sown areas imply clearly the high competition for these land use categories with another, which is much concern for the policymakers. At the state level, forest is also likely to lose its share in coming years which is an alarming situation from ecological point of view.

Projected Land Use Pattern of Gujarat

The area under different land use categories in Gujarat are predicted for next twelve years (TE 2020-21 to TE 2029-30) using transition probabilities and the results are presented in Table 4.

It is evident from the table that the land use categories *viz*; forest, land not available for cultivation and other uncultivable land, except fallow land are likely to lose their area in coming years. The net area sown is likely to remain same or very marginally increase in the future, while area under fallow land may slightly down in years to come. Land use dynamics is likely to retain stable subject

Table 3. Transitional probability matrix for land use categories in Gujarat

Land use category	Period-I: 1970-71 to 1990-91				
	Forest	Land not available for cultivation	Other uncultivable land excluding fallow	Fallow land	Net area sown
Forest	0.509	0.312	0.000	0.000	0.179
Land not available for cultivation	0.000	0.793	0.000	0.207	0.000
Other uncultivable land excluding fallow	0.252	0.000	0.748	0.000	0.000
Fallow land	0.046	0.000	0.110	0.140	0.704
Net area sown	0.017	0.020	0.061	0.000	0.902
Period-II: 1991-92 to 2014-15					
Forest	0.393	0.000	0.538	0.069	0.000
Land not available for cultivation	0.000	0.625	0.375	0.000	0.000
Other uncultivable land excluding fallow	0.000	0.397	0.000	0.000	0.603
Fallow land	0.191	0.043	0.045	0.678	0.043
Net area sown	0.101	0.025	0.040	0.000	0.834
Overall: 1970-71 to 2014-15					
Forest	0.512	0.296	0.000	0.000	0.192
Land not available for cultivation	0.000	0.743	0.048	0.000	0.209
Other uncultivable land excluding fallow	0.257	0.000	0.554	0.189	0.000
Fallow land	0.046	0.024	0.119	0.281	0.530
Net area sown	0.015	0.031	0.094	0.000	0.860

1. Land not available for cultivation includes a) Land put to non-agricultural use, and b) Barren and uncultivable.
2. Other uncultivated land excluding fallow includes a) Permanent pastures and other grazing lands, and b) Cultivable waste.
3. Fallow lands includes a) Current fallow b) Fallow other than current fallow.

Table 4. Projections of land use dynamics in Gujarat

(Area in '00' ha)

Period	Forest	Land not available for cultivation	Other uncultivable land excluding fallow	Fallow land	Net area sown
TE 2020-21	18175.24	35169.34	26915.47	7059.67	102574.16
TE 2023-24	18106.77	34786.29	26875.88	7067.02	102793.80
TE 2026-27	18065.26	34488.32	26856.46	7061.60	102893.45
TE 2029-30	18040.30	34257.58	26839.78	7056.41	102906.08

to non-intervention of any developmental activities in the study area.

The unfavourable trend of forest and fallow lands implies the need of efficient and effective management of the land use with efforts from all the stakeholders through suitable perspective land use planning. These results are in conformity with the findings of Harish (2006); Aravind (2010); Gairhe (2011); Singh (2012); Adhikari & Sekhon (2014).

CONCLUSION AND POLICY IMPLICATIONS

At aggregate level of India, area under non-agricultural uses has increased by 25.96 percent while it has increased by 8.43 percent in case of Gujarat between Period-I (1970-71 to 1990-91) and Period-II (1991-92-2014-15), implying thereby almost three times more increase in India compared to that of Gujarat. The increase in the net area sown was observed at Gujarat state as well as at aggregate level of India, but the increase in case of Gujarat was as high as 4.66 percent while it was only 0.28 percent at national level. For the Gujarat state as whole Net area sown was a major gainer among the different land use categories which gains from fallow land, land not available for cultivation and other uncultivable land excluding fallow land.

The government should initiate pro-active role in provision of input and infrastructural support systems to farmers to bring barren and uncultivable land under cultivation. Soil reclamation programmes should be encouraged and intensive awareness campaigns should be organized to promote soil reclamation. Though conversion of other land categories to non-agricultural use is unavoidable due to population pressure, rapid industrialization etc., it is better to use the undesirable land categories (other uncultivated land excluding fallow) for non-agricultural purpose.

REFERENCES

Adhikari, A., & Sekhon, M.K. (2014). An economic analysis of land use dynamics in Punjab. *International Journal of Advanced Research*, *2*(5), 551-560.

Aravind, K. (2010). *Economics of land use and cropping pattern in Northern transitional zone of Karnataka.* (Master's *Thesis*). University of Agricultural Sciences, Dharwad, Karnataka.

Ashrit, R.R. (2014). Temporal and spatial variations of land usage pattern in the country. *Agricultural Situation in India, 70*(11), 5-12.

Bardhan, D., & Tewari, S.K. (2010). An investigation into land used dynamics in India and land under utilization. *Indian Journal of Economics, Agriculture, 65*(4), 658-676.

Directorate of Economics and Statistics.(2016). 2016a. *State of Indian agriculture, 2015-16*. Directorate of Economics and Statistics, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi. Retrieved from http://eands.dacnet.nic.in/PDF/State_of_Indian_Agriculture,2015-16.pdf.

Gairhe, S. (2011). *Land use dynamics in Karnataka-An economic analysis* (Master's Thesis).University of Agricultural Sciences, Dharwad, Karnataka.

Harish, M.H. (2006). *An economic appraisal of land use dynamics in Mandya district* (Master's Thesis). University of Agricultural Sciences, Dharwad, Karnataka.

Kumar, S., Radhakrishnan, N., & Mathew, S. (2014). Land use change modeling using a Markov model and remote sensing. *Geomatics, Natural Hazards, and Risk*, *5(2),* 145-156.

Mouzam, S.M., Hile, R.B., Swaminathan, B., & Khan, M. (2015). Dynamics of land use and cropping pattern in Andhra Pradesh. *Trends in Biosciences, 8*(6), 1400-1405.

Musande, M.T. (2014). The general land use pattern and changes therein Marathwada region: A geographical analysis. *Avishkar-Solapur University Research Journal, 3*, 120-129.

Ramasamy, C., Balasubramanian, R., & Sivakumar, S.D. (2005). Dynamics of land use pattern with special reference to fallow lands- An empirical investigation in Tamil Nadu. *Indian Journal of Agricultural Economics*, *60*(4), 629-644.

Sharma, V.P. (2015). *Dynamics of land use competition in India: Perceptions and realities*. Research and Publication, Working Paper No. 2015-06-02, Indian Institute of Management, Ahmedabad, India.

Singh, M. (2012). Projection of land use pattern in India: A Markov chain approach. *Annals of Agricultural Research, 33* (1 & 2), 69-78.

Tirlapur, L.N., & Mundinamani S.M. (2015). An economic analysis on land use and cropping pattern in Dharwad district. *International Research Journal of Agricultural Economics & Statistics*, *6*(1), 176-181.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 168-174
DOI: 10.5958/2322-0430.2018.00053.7

NAAS Score: 4.82
www.naasindia.org
UGC Approved

A Comparative Analysis of Crop Diversification between Flood and Drought Prone Areas of Rajasthan

Vinita Kanwal, Divya Pandey, Arti and Sanjeev Kumar*

ICAR-National Dairy Research Institute, Dairy Economics, Statistics,and Management Division, Karnal-132001

**Corresponding author's email: vinitakanwal888@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-141* *Revision Accepted: March 05, 2018*

ABSTRACT

Present study pertains to Rajasthan the largest state of India having varied climatic conditions. Data of different crops pertaining to1980-2014 was used in the study. A comparison has been made for changing cropping patterns in relations to rainfall over the years for two districts i.e. Bikaner and Kota of the state. Transformed Herfindahl Index (THI) and trends were used for estimating the diversification patterns to compare the change in area for different crop categories i.e. cereals, pulses and oilseeds over the years. Kota and Bikaner, two districts of Rajasthan state have contrasting climatic conditions. Kota being in flood-prone zone, farmers prefer growing cereals more. On the other hand, Bikaner being a drought affected district farmers there prefer growing oilseed crops more, as it is drought resistant in nature. Farmers change the area under a particular crop based on the previous year rainfall. Farmers in Rajasthan grow water-intensive crops such as rice and wheat as they get MSP for these crops though less suited for the regions. The government should include oilseeds and pulses under the MSP regime so that farmers feel motivated and incentivized to grow these crops. Agricultural experts should make area specific cropping schedule and extension agents must disseminate these plans to the farmers. Specific cropping plans are more likely to increase farm income.

Keywords
Diversification, drought, flood, Herfindahl-Hirschman's Index.

JEL Code
Q54.

INTRODUCTION

Agriculture is a novel subject matter and is first and foremost backbone of county. Thomas Jefferson has clearly mentioned 'agriculture is our wisest pursuit because it will, in the end, contribute most to the real wealth, good morals and happiness'. History of agriculture in India dates back to Harappa era and ever before that in peninsular India. As of today, India ranks second worldwide in overall farm output after China. Agriculture engages nearly 52 percent population and contributes to 13.7 percent to Indian GDP along with allied sectors.

In past few years the whole world has witnessed a shift in eating habits so did our farming. Our farmers have tried to adjust changing needs of masses from cereals to coarse fruits, vegetables, milk and milk products in all towards a holistic food basket. Still, when we turn pages of history in agriculture our achievements are not overwhelming. We are still lagging behind in capturing fast-changing needs of folks.

After great stroke of green revolution, Indian agriculture has been experimented a lot, be it in plantation crop or horticultural crop Indian agriculture has witnessed drastic changes. But still we are burdened with some inherent traditional problems that come in line with its rainfed nature; use of traditional method of cultivation, traditional cultivars, and half knowledge of new technology, fragmented land holdings, disguised unemployment, etc. From these perspectives improving incomes, generating gainful and year-round employment, stabilizing the flow of income over the season, conservation and augmentation of natural resources, crop diversification, that is, shifting from less profitable crop or enterprise to more profitable crop or enterprise comes out as major strategy (Vyas, 1996).

State of Rajasthan

Considered as a dry desert the state of Rajasthan

contains a variety of climatic zones. From extreme hot and dry desert of Jaisalmer and Bikaner to flood-prone Kota and Pali. These are the regions that witness its vast climatic variation. But climate of Rajasthan has also gone through major changes and so does the vegetation of the area. So this paper is an attempt to capture changing cropping pattern of the two extreme climate districts, thatis, Bikaner (drought prone) and Kota (flood prone) and their comparison within in terms of rainfall, cropping pattern and diversification therein.

Keeping in view the above points the present studies tries to identify the percentage change in area under oilseeds, pulses and cereals in worst drought and flood-prone districts of Rajasthan viz. Bikaner and Kota respectively. The study further tries to find whether the producers try to minimize the risk which arises due to the rainfall extremities. Lastly, present study also tries to find the link between rainfall and how it affects the area allocated to different crops over the years.

Data

Rajasthan a western state of country is affected from moderate to severe droughts that contributes major source of risk in the area for agriculture sector. Poor rainfall pushes the farmers in vicious cycle of poverty that in turn give rise to food insecurity in the area. There is a dearth of studies that quantifies the risk arising due to droughts and measures the efficiency of coping mechanism adopted by the communities of area pertaining to drought-prone area.

The data regarding area of pulses, oilseeds, and cereals in present study was collected for years 1980 to 2014 from many secondary sources including VDSA, Vital statistics of Rajasthan and Agriculture situation in India. The data for rainfall was collected from IMD (Indian meteorological department) on 0.25 grid scale

Methodology

To find out the percentage change in area over the years in pulses, oilseeds and cereals and proportionate change of area under the particular crops in the above-mentioned food groups the following method was used-

$$\text{Percent change in area} = \frac{ACiDj}{GCADj} * 100$$

Where,

ACi =area of ith crop

Dj= Jth district

GCA= Gross cropped area of jth district

There are quite a few measures of diversification; important ones include Herfindahl Index, Simpson Diversity Index, Ogive Index,and Entropy Index. Properties of a diversification measure, however, will also need to reflect the nature of problem studied. (Bhattacharya, 2008). To assess the magnitude of crop diversification, Herfindahl-Hirschman's Index (HHI) has been used, i.e.

$HHI = \Sigma Pi^2$

Where,

$Pi = Ai / \Sigma Ai$

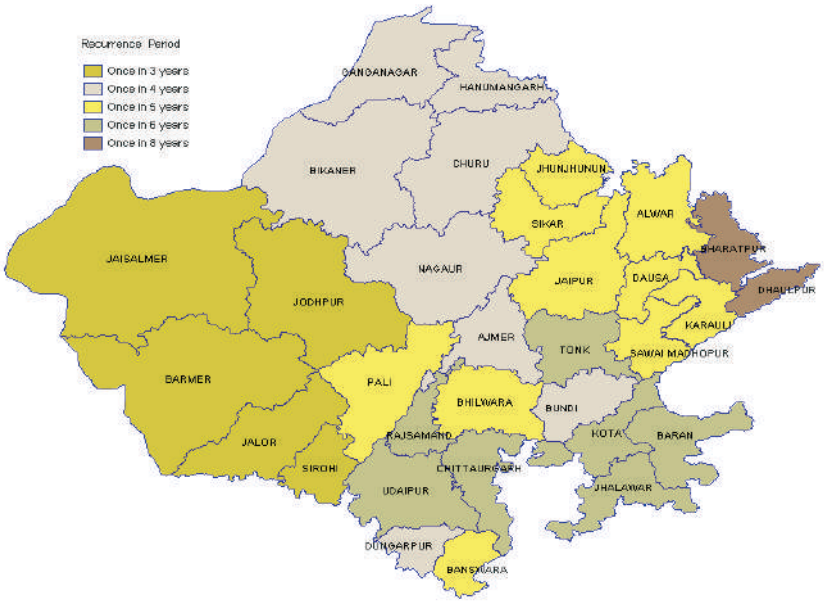
Pi=Proportion of area under i^{th} crop,

Ai=Actual are under i^{th} crop

The index is defined as a sum of squares of all 'n' proportions. This is a simple measure of concentration.

For increasing diversification, HHI is decreasing and vice-versa. It is bounded by 0 (complete diversification) and 1 (complete specialization)

Since the Herfindahl Index is a measure of concentration, it was transformed by subtracting it from one, (THI= 1-HI or THI= $(1- \Sigma Pi^2)$. The transformed



Source: Government of Rajasthan, Jaipur

Figure. 1. Frequency of droughts in Rajasthan

value of HI will avoid confusion to compare it with other indices. The value of transformed Herfindahl Index (1-HI) increases with the increase in diversification and assumes 0 (zero) value in case of perfect concentration i.e. when only one crop is cultivated (Pal & Kar, 2012)

To find out the link between rainfalls in previous year to area allocation in next year, annual rainfall pattern over the years to that cropping pattern over the years were studied to find out how farmers allocate area to the different crops and whether rainfall intensity in previous year has any effect on the crop choice in next year.

RESULTS AND DISCUSSIONS

The results of the study have been underlined in the section.

Percentage Change in the Area

The results of the study show that there are huge variations in the percentage change in area under cereals, pulses, and oilseeds over the years in Bikaner (Figure 2a). The area under cereals and pulses has been declining but the area under oilseeds has been showing an increasing trend in the past few years. This shows that the farmers in Bikaner; the drought affected district are preferring oilseed crop as the crop can be grown with meager water available and is quite hardy and drought resistant.

Situation in Kota is quite opposite that of Bikaner as percent area under oilseeds has been on decreasing side but area under pulses and cereals has been increasing (Fig 2b). The area under oilseeds though was more initially but in recent years it is on a declining trend this can be attributed to climate shifting regime of the area since 1980s. Pulses and cereals area is showing increasing trend in recent years after showing a downward trend previously. This shows that the farmers in Kota are growing crops which require a good amount of water as Kota witnesses an ample amount of rainfall which goes well with the crop selection.

Cereals

In Bikaner, the farmers grow cereal crops but over the year the percentage area under the cereal crop has decreased (Figure 3a). The farmers mainly go for rice and wheat

In Kota, the farmers have been inclined to grow water-intensive crop i.e. rice which is evident from increase in the percentage area change (Figure 3b). Area under wheat has also shown an increasing trend. Apart from these two farmers also grow maize, sorghum, pearl millet marginally but the area under these crops has decreased. Government support in the form of MSP for rice and wheat as well as the National food security act of 2013 is major reasons and thus farmers are more inclined to grow these two crops only.

Pulses

The area under pulse has decreased significantly and is showing a downward trend in Bikaner (Figure 4a). The main pulses that are grown in the district are Moong and Cowpea.

The area under pulse crop in Kota is also spiraling

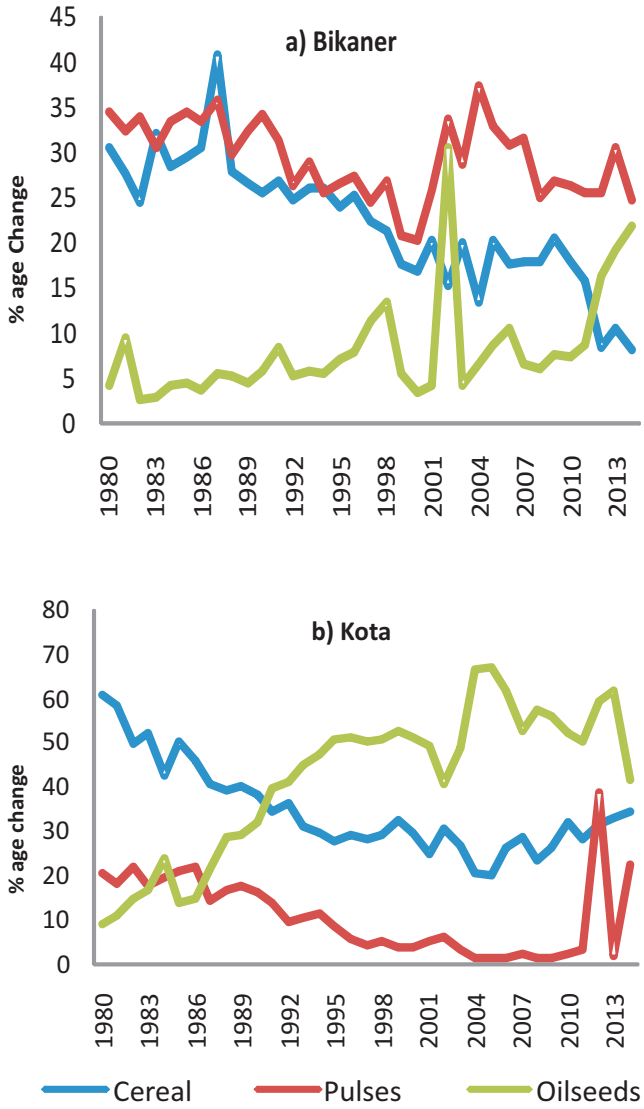


Figure 2. Percentage change in area of different crops

downward (Figure 4b) and cowpea and moong were preferred crops that were grown here.

Oilseeds

The area in Bikaner has increased under oilseed (Figure 5a) as the district is drought-prone and these crops are suitable for such conditions thus farmers in the district are favoring these over other crops. Groundnut, rapeseedand Mustard are major oilseed crops that are grown, sesame is also grown but the area under the crop has reduced.

The oilseed crops that are grown in Kota are Soyabean and Rapeseed and mustard but their area has decreased in past few years. Sesame is also grown marginally in this district.

Diversification

The study has used Herfindahl Index to measure diversification. The limit of the index is 0 to 1, 0 being complete diversification and 1 being complete specialization. The Herfindahl Index was transformed by

subtracting it from one to get transformed value. It assumes 0 in case of perfect concentration i.e. when only one crop is cultivated.

Though the area under cereals is increasing in Kota still the farmers don't depend solely on one crop, that is, rice but also and go for combination of cereal crops as can be seen from Table 1 and the same goes with Bikaner as the THI (Transformed Herfindahl Index)is very close to 1 and in 2014 the Value 1 which shows absolute diversification.

The diversification index for pulses in Bikaner and Kota also shows a diversification scenario (Table 1). Since beginning the value has been almost 1 and after 1996 the value has been absolute 1 this shows that farmers do not allocate area to just one pulse crop but they go for various proportions of a pulse crop mix. The same has been the case with Bikaner district.

In case of oilseeds, the value has been 1 to almost 1 in Bikaner district (Table 1). The area of oilseeds in Bikaner has also shown an increasing trend and the index shows that the farmers prefer to grow mix of the oilseed crops. In Kota, the value is also close to 1 but has been decreasing along with decreasing area under this crop in the district. The farmers in Kota also are shifting their cropping pattern to pulses and cereals but also grow oilseeds though don't go for a mix of oilseeds but grow only few types of the crop.

Effect of Rainfall on Area Allocation of Crop

There is wide variation in rainfall pattern in the two districts of the State (Figure 6). Kota has witnessed a high amount of rainfall and has been prone to floods and Bikaner has witnessed lower rainfall and is prone to droughts. In some years though Kota has witnessed lower rainfall than previous years and Bikaner has witnessed

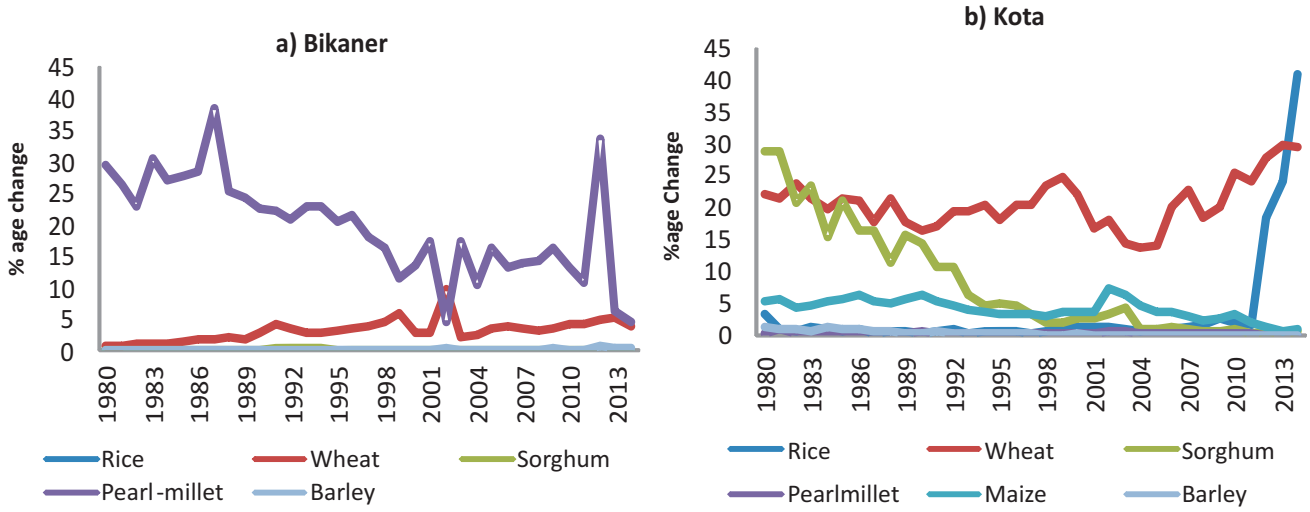


Figure 3. Percentage change in area under different cereal crops

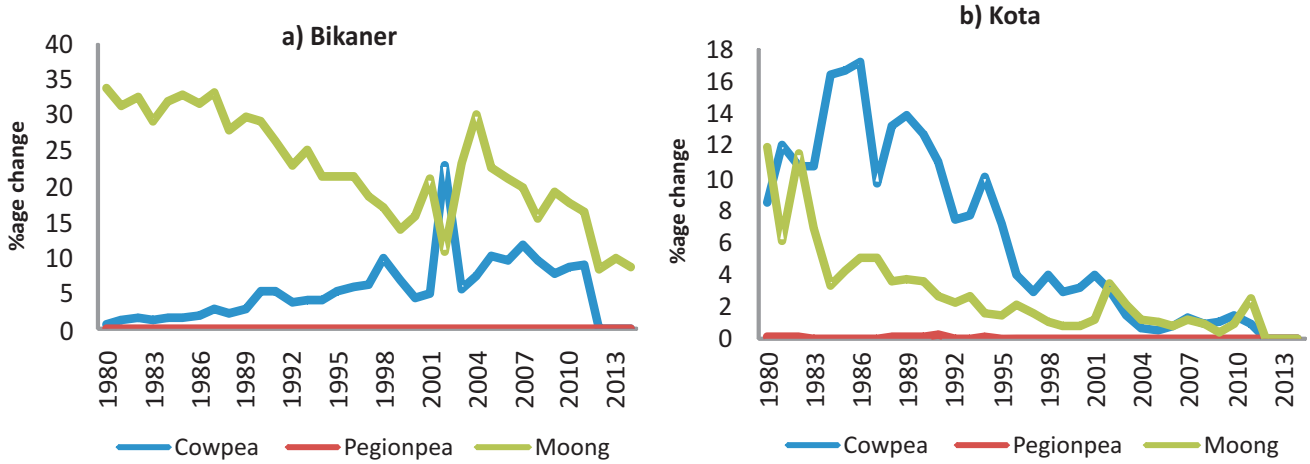


Figure. 4. Percentage change in area under pulses

higher rainfall than the previous years. An effort has thus been made to see whether this rainfall pattern affects the cropping are in the districts.

In Kota mostly whenever the rainfall has been high the area under cereals crops has shown an increasing pattern (Figure 7b). Such as in 1982 when the rainfall has been high the area under cereals in 1983 has also peaked. Same has been the case in the year 2006 when the rainfall peaked the area under cereals in 2007 peaked. When the rainfall has been on a lower side then the area under oilseed crop has increased the next year. For example, when rainfall was less in 1983 the farmers allocated more are to oilseeds in 1984, same goes the situation when rainfall was less in 1998. This shows the risk aversion behavior of framers and that the area to be allocated under crop is proportional to the rainfall witnessed in previous years.

Rainfall in Bikaner is showing an overall declining pattern and in response to that, the area under oilseeds is showing an increasing pattern as oilseeds can be well maintained under drought season with scant water. Cereals area is on declining trend with the scanty rainfall that Bikaner gets (Figure 7a). The farmers vary their crops between pluses and cereals when the rainfall has been higher in previous year but they also increased the area under oilseeds to avoid risk. On the other hand, Kota

Table 1. Diversification Index of cereal, pulses, and oilseeds

Year	Cereals		Pulses		Oilseeds	
	Bikaner	Kota	Bikaner	Kota	Bikaner	Kota
1980	0.91	0.86	0.89	0.98	1.00	1.00
1981	0.93	0.87	0.90	0.98	1.00	1.00
1982	0.95	0.90	0.89	0.98	1.00	0.99
1983	0.91	0.90	0.91	0.98	1.00	0.99
1984	0.93	0.94	0.90	0.97	1.00	0.98
1985	0.92	0.91	0.89	0.97	1.00	1.00
1986	0.92	0.93	0.90	0.97	1.00	0.99
1987	0.85	0.94	0.89	0.99	1.00	0.99
1988	0.93	0.94	0.92	0.98	1.00	0.97
1989	0.94	0.94	0.91	0.98	1.00	0.97
1990	0.95	0.95	0.91	0.98	1.00	0.96
1991	0.95	0.96	0.93	0.99	1.00	0.92
1992	0.96	0.95	0.95	0.99	1.00	0.93
1993	0.95	0.96	0.94	0.99	1.00	0.92
1994	0.95	0.96	0.95	0.99	1.00	0.90
1995	0.96	0.96	0.95	0.99	1.00	0.88
1996	0.95	0.96	0.95	1.00	1.00	0.88
1997	0.97	0.96	0.96	1.00	1.00	0.88
1998	0.97	0.94	0.96	1.00	1.00	0.86
1999	0.98	0.94	0.98	1.00	1.00	0.86
2000	0.98	0.95	0.97	1.00	1.00	0.86
2001	0.97	0.97	0.95	1.00	1.00	0.87
2002	0.99	0.96	0.94	1.00	0.99	0.90
2003	0.97	0.97	0.94	1.00	1.00	0.89
2004	0.99	0.98	0.90	1.00	1.00	0.78
2005	0.97	0.98	0.94	1.00	1.00	0.78
2006	0.98	0.96	0.95	1.00	1.00	0.81
2007	0.98	0.95	0.95	1.00	1.00	0.86
2008	0.98	0.96	0.97	1.00	1.00	0.84
2009	0.97	0.96	0.96	1.00	1.00	0.85
2010	0.98	0.93	0.96	1.00	1.00	0.89
2011	0.99	0.94	0.96	1.00	1.00	0.85
2012	0.88	0.89	0.99	1.00	0.99	0.81
2013	0.99	0.85	0.99	1.00	0.99	0.76
2014	1.00	0.75	0.99	1.00	0.99	0.89

receives ample rainfall during monsoon season but here too the area under oilseeds is more than the area under cereal and pulses and this might be due to non-uniform distribution of rainfall in a year. Rainfall amount is ample but it is restricted to 90-120 days only and which leads to pseudo flooding for some days and on rest of the days this area is drought again.

SUMMARY AND CONCLUSIONS

Rajasthan is the biggest state of India and has varying agro-climatic conditions. Some of the parts witness ample amount of rainfall and are flood prone and on the other hand, some parts receive scanty rainfall and drought-prone. The following study tried to compare the cropping pattern in two districts viz. Kota and Bikaner, which had a wide variations in rainfall, the former being flood prone and latter being drought prone. The farmers in Bikaner prefer crops which do not consume high water such as oilseeds whereas in Kota the farmers go for cereals as they can afford such water-intensive crops. Though farmers prefer the crops that are adaptive to their climatic condition, they still diversify their cropping pattern and cultivate different types of crops among their preferred

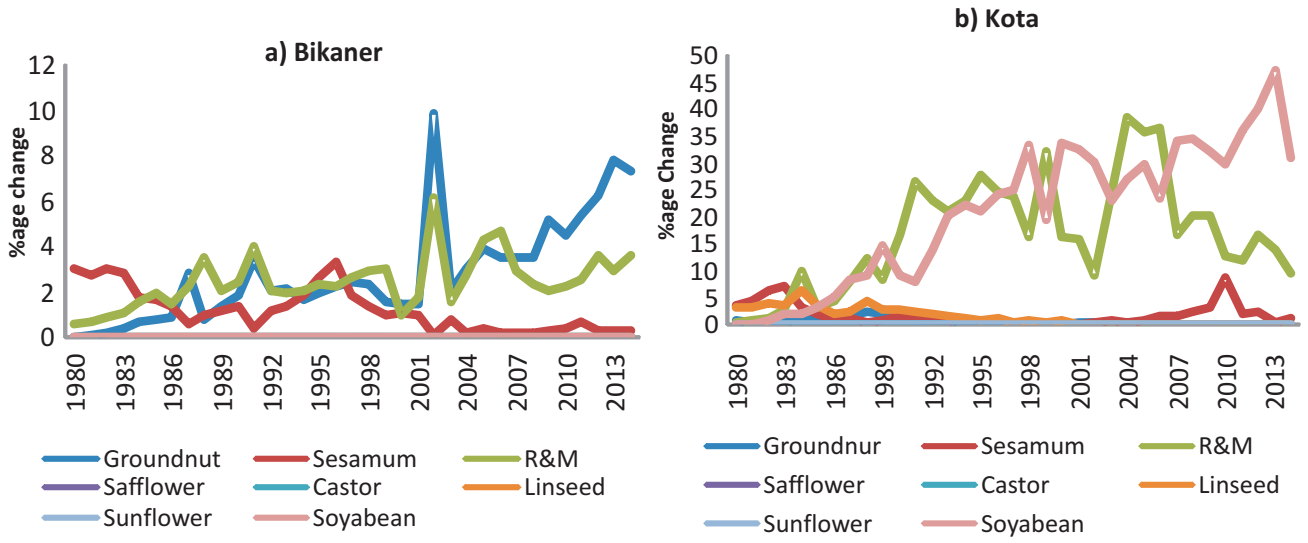


Figure. 5. Percentage change in area under oilseeds

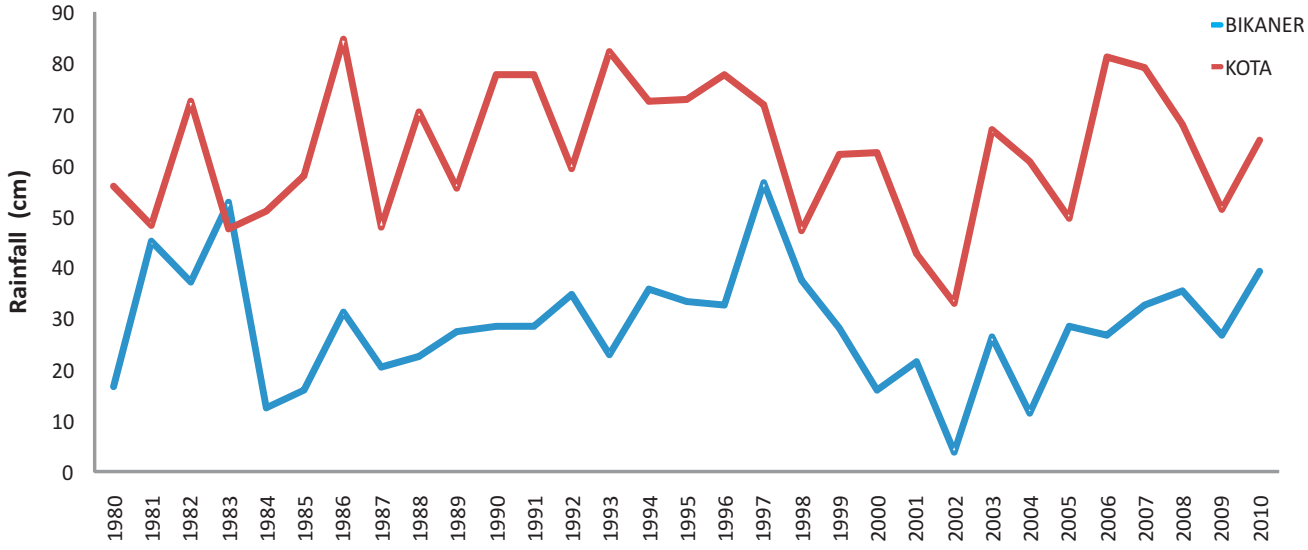


Figure. 6. Annual rainfall pattern in Kota and Bikaner

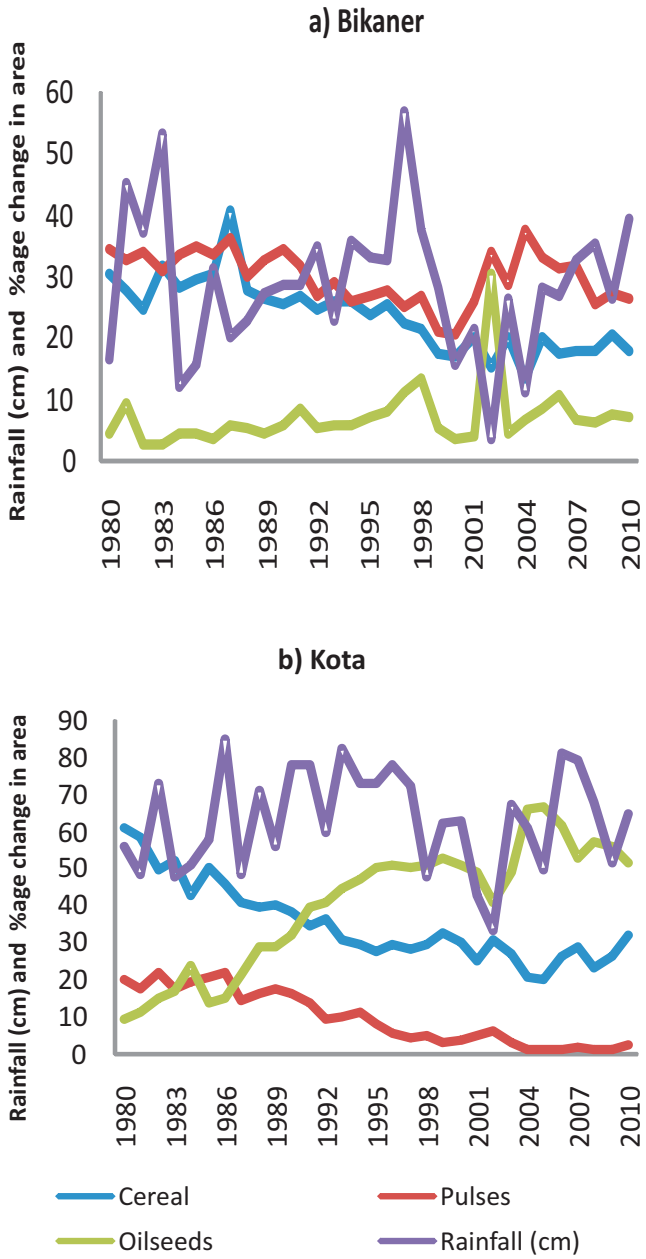


Figure. 7. Annual Rainfall to change in area

crop cultivation as well as other crops such as pulses. The farmers also cultivate a certain crop keeping in mind the amount of rainfall they have observed the previous year. They prefer to allocate a comparative more area to water-intensive crop if good amount of rainfall has been received the previous year and would allocate more area to drought-resistant crop if less rainfall has been received previous year.

As the conditions in the state are preferable to drought-resistant crops still the farmers cultivate water-intensive crops such as wheat and rice. This is due the reason that farmers get MSP for these crops and because of this, they cultivate these crops whether it is favorable or not. The government should include oilseeds and pulses under the MSP regime so that farmers feel motivated and confident to grow these crops. This will lift pressure off the declining water resources and will stabilize the price of the pulses and oilseeds. The farmers should be provided with drought-resistant varieties and cultivars. The agricultural experts should plan the area specific cropping pattern and the extension officers must make sure that it reaches the farmers and gains popularity.

REFERENCES

Bhattacharya, R. (2008). Crop diversification: A search for an alternative income of the farmers in the state of West Bengal in India. Presented at *International Conference on Applied Economics*. Retrieved from https://pdfs.semanticscholar.org/cf73/33975ec5c9bd863108da24f7af3879a90106.pdf

Pal, S., & Kar, S. (2012). Implications of the methods of agricultural diversification in reference with Malda District: Drawback and rationale. *International Journal of Food, Agriculture and Veterinary Sciences,2*(2), 97-105.

Vyas, V.S. (1996). Diversification in agriculture: Concept, rationale and approaches. *Indian Journal of Agricultural Economics*, *51*(4), 636-646.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 175-179
DOI: 10.5958/2322-0430.2018.00054.9

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Instability and Sustainability Analysis of Mustard in Bhind (Madhya Pradesh) and Relationship with Factors of Production on Productivity

Ankit Soni[1], Pradeep Mishra[2], R.B. Singh[3], H.K. Niranjan, J.K. Gupta[4] and Supriya[5]*

Research Scholar, Mahatma Gandhi Chitrakoot Gramodaya Vishwa Vidyalaya, Satna, Madhya Pradesh
[2]Assistant Professor, College of Agriculture, JNKVV, Powarkheda, Hoshangabad-461110(M.P.)
[3]Professor, Department of Mathematics and Statistics, College of Agricultural, JNKVV, Jabalpur-482 004 MP)
[4]Professor, Mahatma Gandhi Chitrakoot Gramodaya VishwaVidyalaya, Satna, Madhya Pradesh and
[5]College of Agriculture Sciences, Teerathanker Mahaveer University, Moradabad (UP) 244001

[*]Corresponding author's email: pradeepjnkvv@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-146* *Revision Accepted: March 10, 2018*

ABSTRACT

The oilseed crops play a crucial role in Indian agricultural economy. The oil content varies from 37 to 49 percent. Oil is utilized for human consumption, seeds as spices and cake as a cattle feed and manure. Mustard is also an important oilseed crop containing over 40 percent oil on a dry weight basis. Madhya Pradesh (MP) is the fourth major mustard producing the state in India followed by Gujarat and West Bengal, with a share of nearly 11 percent of the country's total mustard production. In present study sustainable growth in the area, production and yield of mustard during the period under investigation for whole Madhya Pradesh. While Madhya Pradesh is found sustainable in the area, production and productivity as compared to Bhind district, which is a witness that Bhind district is having more fluctuation in the area, production and productivity of mustard during the study under investigation. Hence, in recent years a concept of sustainable agriculture is developed in order to ensure that the agro-eco-systems are stabilized and sustained crop yields are assured on a long term basis.

Keywords
Factors of production, instability, regression, sustainability.

JEL Codes
C43, C81, C51, C52, O13, Q56.

INTRODUCTION

Historically mustard is one of the earliest domesticated crop plants by man. Seeds of mustard were found from the channel - Daro of Harrapan civilization. Indian mustard (*Brassica juncea*) is predominantly cultivated in the states of Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh, and Gujarat which contribute 81.5 percent area and 87.5 percent production (2001-02 to 2005-06) (AICRPRM, 2007). Its cultivation is also being extended to non-traditional areas of Southern States like Karnataka, Tamil Nadu, and Andhra Pradesh. Madhya Pradesh (MP) is the fourth major mustard producing a state in India followed by Gujarat and West Bengal, with a share of nearly 11 percent of the country's total mustard production. The cultivation of brown sarson which once dominated the entire rapeseed-mustard growing region is now shadowed by Indian mustard. Mustard seeds are a particularly good source of the mineral selenium, providing almost 15 percent of the daily value for adults as recommended by the Food and Nutrition Board of the Institutes of Medicine. Sahu, & Mishra (2014**)** studied instability and forecasting the production of maize in India. Mishra *et al.* (2015) attempted the study of wheat sustainability and forecasting in India.

MATERIAL AND METHODS

The present study deals with the methodological details adopted for the fulfilment of the objectives of the present study. The nature and source of data collection of the methodology for examining descriptive statistics, trend and growth, instability, and sustainability yield index of the data analysis for the study are dealt in detail under following heads. Descriptive Statistics are used to

present quantitative descriptions in a manageable form. In a research study, we may have lots of measures. Or one may measure a large number of people on any measure. Descriptive statistics help us to simplify large amounts of data in a sensible way. Each descriptive statistic reduces lots of data into a simpler summary.

Correlation Coefficient

To measure the degree of linear association ship we shall use Karl Pearson's correlation coefficients. Correlation coefficient measures the degree of closeness of the linear association ship between any two variables and is given as

$$r_{xy} \quad \frac{Cov\,(x, y)}{s_x . s_y}$$

Regression

Regression is the measure of the average relationship between two or more variables in terms of the original units of the data. If two variables are correlated, unknown value of one of the variables can be estimated by using the known value of the other variable. Estimated value may not be equal to the actually observed value, but it will be close to the actual value. In a wider usage, regression is the theory of estimation of the unknown value of a variable with the help of known values of the variables.

$$(y \quad \bar{y}) \quad b_{yx}(x \quad \bar{x})$$

Here, the constants b_{xy} and b_{yx} are the regression coefficients. They are:

$$b_{xy} \quad \frac{r \quad x}{y} \quad \frac{n \quad xy \quad (\quad x)(\quad y)}{n \quad y^2 \quad (\quad y)^2} \; or\, b_{xy} \quad \frac{Cov\,(x, y)}{Var\,(y)}$$

$$b_{yx} \quad \frac{r \quad y}{x} \quad \frac{n \quad xy \quad (\quad x)(\quad y)}{n \quad x^2 \quad (\quad x)^2} \; or\, b_{yx} \quad \frac{Cov\,(x, y)}{Var\,(x)}$$

Instability

For measuring the instability in area, production and yield the index given by Cuddy & Della (1978) and used by Larson *et al.* (2004):

$$CV_t \quad (CV)\, x \sqrt{1 \quad R^2}$$

Cv_t = (CV) where,

$$C.V. \quad \frac{}{\bar{X}} \quad 100$$

Where = Standard Deviation

$\bar{X}$ *Mean*

R^2 = coefficient of determination of the linear trend model of the variable concerned.

CVt = CV around trend

The more general option is to use ordinary CV value but in presence of trend, ordinary CV fails to explain the inherent trend component in a time series properly (Hasan *et al.*, 2008). So, Cuddy & Della (1978) method is assumed to be superior to ordinary CV. In present study period has divided into two periods, Period-1 (2005-2010), and Period-II (2011-2016)

Importance of Sustainability in Agriculture

Production of major crops in a sustainable manner is the need of the hour. Sustainability can be defined only by the boundaries of a system's framework, that is, after the specification of what is to be sustained. Choosing the boundary is difficult because agricultural systems operate at multiple levels: soil-plant system, cropping system or farming system, agro-ecosystem and so on to higher regional, national, and global levels (Lynam, 1994).

Sustainability Index (SI)

(1) Singh *et al.* (1990) have given the following measures of sustainability. Sustainability Index (S1) $\frac{\bar{y} \quad s}{y_{max}}$

where is the average yield of a treatment, s is the standard deviation of yields over the years and y_{max} is the maximum yield of a treatment in any year. Higher the value of the index, higher is the sustainability status

(2) Sahu *et al.* (2005) $SI \quad \frac{Y_{max}\, a \quad \bar{Y}}{\bar{Y}}$

sustainability index value closer to zero is the most desirable value.

(3) Pal & Sahu (2007) $SI \quad \frac{s_i}{\bar{y}_i} \cdot \frac{1}{s_{max}}$

lower the value of the sustainability index higher is the sustainability.

RESULTS AND DISCUSSION

The effect of the expansion of area in Bhind is clearly visible (Table 1) in the production scenario of mustard. With a mere 136.50 thousand tonnes of production, it has reached to 341 thousand tonnes during the year 2016.A simple growth rate of -3.11 percent is registered during the period. Platykurticnature of production indicates that there has been a continuous force on enhancing production of these crops during the period. So the effect of area decreased.

Increased production of would not have been possible without a substantial increasing per ha yield of the crop,but here decreasing area and production effect clearly visible in productivity. Starting with only 932 kg of wheat per ha, it has reached to 1707 during the year 2016 thereby registering the simple result of -1.56 percent (Table 1). Thus the joint effect of expansion area and production has resulted in a brighter picture of mustard production scenario in Bhind. So the reason behind this decline in area and production may be farmer's adopted others crops taken place or environmental factor effect.

Correlation between Climatological and Productivity of Mustard

At the time of setting the objective for the present study, we assumed that the factors (rainfall, maximum and minimum temperature) are supposed to have a great role in the productivity of mustard. In this section, attempts have been made to work out the degree of linear

association ship and the linear relationship among these parameters for rice crop. Correlation, regression analysis is taken up to find out the extent and actual linear relationship of productivity on these parameters. Mustard in Bhind producing including whole Madhya Pradesh (Table 2) it is found that productivity yield is significant. There was the negative significant effect of rainfall, the average minimum temperature on mustard productivity.

In order to find out the relationship of yield with above factors, multiple linear regression equations are fitted. The most important factors affecting crop productivity is identified by using linear regression analysis (Table 3). A significant positive coefficient of maximum temperature on the productivity of mustard in Bhind and Madhya Pradesh is noticed. A temperature would lead to an increase in productivity of mustard crop by 49 and 69 kg/ha. So by seeing the correlation between maximum temperature and productivity matching the results of regression.

Instability of Mustard

Variability in agricultural production consists of variability in area and yield and their interactions. Variation in the area under a crop occurs mainly in response to distribution, timeliness, and variations in rainfall and other climatic factors, expected prices and availability of crop-specific inputs. Demand for food tends to grow in proportion to changes in population and

Table 1. Performance of mustard in Bhind and Madhya Pradesh (2005-2016)

Particular	Area	Production	Yield	Maximum temperature	Minimum temperature	Rainfall
Bhind						
Mean	169.83	222.55	1314.08	45.17	35.42	722.88
Standard Error	10.80	18.00	80.23	0.67	1.13	60.52
Kurtosis	5.88	-0.08	-1.38	-1.31	8.16	3.52
Skewness	2.11	0.47	0.26	0.43	2.67	1.56
Minimum	130.00	136.50	932.00	42.00	32.00	447.00
Maximum	274.20	341.00	1707.00	49.00	47.00	1261.90
SGR (percent)	-0.39	-3.11	-1.56	0.52	-0.64	1.95
Madhya Pradesh						
Mean	758.70	865.18	1129.00	31.66	20.17	969.95
Standard Error	22.74	60.77	49.06	0.29	0.26	32.37
Kurtosis	1.42	0.86	1.15	-1.68	-1.38	0.28
Skewness	-0.81	0.88	1.36	-0.09	-0.02	-0.88
Minimum	579.20	536.80	927.00	30.23	18.70	733.50
Maximum	872.00	1275.00	1480.00	33.05	21.54	1101.70
SGR (percent)	0.85	5.56	4.55	0.84	-1.12	-3.08

Table 2. Correlation of factors related with the productivity of mustard in Bhind and Madhya Pradesh

Particulars	Yield	Maximum temperature	Minimum temperature	Rainfall
Bhind				
Yield	1			
Maximum temperature	0.119*	1.000		
Minimum temperature	-0.290	0.450	1.000	
Rainfall	-0.017	0.265	-0.203	1
Madhya Pradesh				
Yield	1.000			
Maximum temperature	0.532*	1.000		
Minimum temperature	-0.459	-0.857	1.000	
Rainfall	-0.467	-0.598	0.495	1

Table 3. Regression analysis of factor affecting the productivity of mustard in Bhind and Madhya Pradesh

Term	Coefficients	Standard error	t-value	p-value
Bhind				
Constant	611	1708	0.36	0.730
Maximum temperature	49.7	46.1	1.08	0.312
Minimum temperature	-37.2	27.0	-1.38	0.205
Rainfall	-0.31	0.467	-0.66	0.526
Madhya Pradesh				
Constant	-715	5656	-0.13	0.903
Maximum temperature	69	115	0.60	0.564
Minimum temperature	-4.02	106	-0.05	0.963
Rainfall	-0.29	0.468	-0.64	0.541

income; yet, food supply can be very unstable. Production instability leads to market and food price volatility, and this volatility causes wide swings in consumer prices and producer incomes. All these factors also affect the variations in yield. The main concern in the strategy for agricultural development in India has been agricultural growth with stability as a way to meet the increasing demand for food.

Plant protection measures, chemicals, fertilizers, and mechanizationFurther, the yield is also affected by the outbreak of diseases, pests, and other natural.After seeing the per performance and trend, it is important to study the instability of crop in a different period. So for this period has divided into two periods as mentioned in material and method section. For Bhind in mustard in area and production, Period-I found more instability as compare to Period-II and whole period (Table 4). But in case of productivity in Period-II found variability. For whole Madhya Pradesh story is quite different in the area. In Period-II instability is more as compare to Period-I and whole period in the area, production, and productivity.

In present study period has divided into two periods.

(1) Period-1 (2005-2010)

(2) Period-II (2011-2016)

Sustainability of Mustard

Crop yields remaining stagnant, pesticides polluting the eco-systems, increasing the cost of fertilizers, reducing soil fertility, an imbalance in host-parasite and predator - parasite relationships have pushed agriculture into the dangerous mode. Scientists have looked back into the technologies evolved and used to increase the crop yields. Long-term projections have indicated that agriculture is pushing itself towards stagnation with severe damage to ecosystems.

Sustainability in productivities of mustard in Bhind and Madhya Pradesh has been measured with the help of sustainability indices as described in material and method section and has been presented in Table 5. So from table Whole Madhya Pradesh is found sustainable in the area, production and productivity as compared to Bhind district, which is the witness that Bhind district is having

Table 4. Instability in the area, production, and yield of mustard in Bhind and Madhya Pradesh

Particular	Area	Production	Yield
Period-I (Bhind)			
R^2	0.28	0.19	0.79
CV	26.05	29.87	18.69
CV_t	22.15	24.13	4.02
Period-II (Bhind)			
R^2	0.88	0.41	0.23
CV	14.66	28.24	24.31
CV_t	1.77	21.69	18.75
Whole Period (Bhind)			
R^2	0.39	0.63	0.70
CV	10.38	24.33	15.05
CV_t	8.10	14.88	8.19
Period-I (Madhya Pradesh)			
R^2	0.67	0.70	0.88
CV	7.50	23.22	16.04
CV_t	4.33	12.63	5.65
Period-II (Madhya Pradesh)			
R^2	0.22	0.18	0.21
CV	22.03	28.02	28.02
CV_t	19.45	25.38	24.92
Whole Period (Madhya Pradesh)			
R^2	0.39	0.63	0.70
CV	10.38	24.33	15.05
CV_t	8.10	14.88	8.19

Table 5. Sustainability measurement

	Area	Production	Yield
Bhind			
SI-1	169.69	222.36	1313.92
SI-2	273.20	340.00	1706.00
SI-3	61.22	77.88	58.78
Madhya Pradesh			
SI-1	758.61	865.01	1128.89
SI-2	871.00	1274.00	1479.00
SI-3	0.003	0.003	0.003

more fluctuation in the area, production and productivity of mustard during the study under investigation.

CONCLUSIONS

There has been sustainable growth in area, production, and yield of mustard during the period under investigation for whole Madhya Pradesh. Increased production of would not have been possible without a substantial increasing per ha yield of the crop, but here decreasing area and production effect clearly visible in productivity. In Bhind with only 932 kg of Mustard per ha, it has reached to 1707 during the year 2016 thereby registering the simple result of -1.56percent. In case of the area during the Period-I experienced the highest degree of instability in Bhind. In case of production Madhya Pradesh showing higher instability in Period-II. While Madhya Pradesh is found sustainable in the area, production and productivity as compared to Bhind district, which is a witness that Bhind district is having more fluctuation in the area, production and productivity of mustard during the study under investigation.

REFERENCES

AICRP-RM. (2007). *Annual Progress Report of All India Coordinated Research Project on Rapeseed-Mustard*, pp. A1–16, 2007. Indian Council of Agricultural Research, New Delhi.

Cuddy, J.D.A., & Della, V.P.A. (1978). Measuring the instability of time series data. *Oxford Bulletin of Economics and Statistics,40*(1), 79-85.

Hasan, M.N., Miah, M.A.M., Islam, M.S., Islam, Q.M., & Hossain, M.I. (2008). Change and instability in area and production of wheat and maize in Bangladesh. *Bangladesh Journal of Agricultural Research,33*(3), 409-417.

Lynam, J.K. (1994). Sustainable growth in agricultural production: The links between production, resources, and research. In Goldsworthy, P. and Penning de Vries, F.W.T (Eds.). *Opportunities, use, and transfer of systems research methods in agriculture in developing countries*. Dordrecht, Netherlands: Kluwer Academic Publishers, pp 3-28.

Mishra, P., Sahu, P.K., Dhekale, B.S., & Vishwajith K.P. (2015). Modeling and forecasting of wheat in India and their yield sustainability. *Indian Journal of Economics and Development*, *11*(3), 637-647.

Pal, S., & Sahu, P.K. (2007). On the assessment of the sustainability of crops and cropping system: Some new measures. *Journal of Sustainable Agriculture*, *31*(3), 43-54.

Sahu, P.K., Kundu, A.L., Mani, P.K., & Pramanick, M. (2005). Sustainability of different nutrient combination in a long-term rice-wheat cropping system. *Journal of New Seeds,7*(3), 91-101.

Singh, R.P., Das, S.K., Bhaskar, R.V.M., & Reddy, N.M. (1990). *Towards sustainable dryland agricultural practices*. Technical Bulletin, Central Institute for Dryland Agriculture, Hyderabad, India, pp. 106.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 180-184
DOI: 10.5958/2322-0430.2018.00055.0

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Economics of Marketing and Constraints of Finger Millet in South Gujarat Region

V.B. Tandel[1], V.M. Thumar[2], Narendra Singh[3] and P.V. Gamit[4]*

[1 and 4]Research Scholars, [2] Associate Professor, Department of Agricultural Economics and [3]Associate Professor and Planning Officer, Directorate of Research, N.A.U., Navsari-396450

[*]Corresponding author's email: vishal.tandel2164@gmail.com

Received: December 26, 2017 *Manuscript Number: NS-18-34* *Revision Accepted: February 13, 2018*

ABSTRACT

A study was conducted on the economics of marketing channels marketing efficiency and constraints of finger millet in South Gujarat region. In Valsad district, producer received the price ₹1800, ₹1830 and ₹1825 per quintal which is 97.10, 83.51, and 71.34 percent of consumer's rupee and in Dang district, producer received the price of ₹1700, ₹1650, and ₹1630 per quintal which is 97.05, 82.90, and 71.55 percent of consumer's rupee in Channel-I, II and III respectively. In marketing the lack of transportation facility was ranked as the most important constraint.

Keywords

Constraints, cost of marketing, marketing channel, marketing margin, price spread.

JEL Codes

Q12, Q13, Q14, Q15, R23.

INTRODUCTION

Finger millet [*Eleusine coracana* (L.) Gaertn.] is one of the most important millet crop belonging to family Poaceae and sub-family Chloridoidae. The majority of worldwide finger millet farmers grow it rainfed, although yields often can be significantly improved when irrigation is applied. In India, finger millet is a typical *rabi* crop. Heat tolerance of finger millet is high. Furthermore, it can tolerate soil salinity up to a certain extent. Its ability to bear waterlogging is limited, therefore, good drainage of the soils and moderate water holding capacity are optimal. Finger millet can tolerate moderately acidic soils but also moderately alkaline soils.

India has been a predominantly agrarian economy and agriculture continues to be the mainstay of our economy even today. With the globalization, the agricultural sector is opened up with the new avenues especially for cereal crops and millets. In India, Karnataka is the leading producer of ragi with 53.94 percent of the total area and 53.36 percent of the total production of the crop followed by Tamil Nadu, Uttaranchal, Maharashtra and Andhra Pradesh. Finger millet cultivation in India occupies a total area of 2.0 million hectares (Venkataramana *et al*., 2015).

OBJECTIVES

i. to identify the marketing channel of finger millet and to work out marketing cost, marketing margin, and price spread, and
ii. to identify the constraints in production and marketing of finger millet.

METHODOLOGY

From South Gujarat region two districts namely Valsad and Dang selected purposively. It has been reported that there are 3 talukas in Dang district and 2 talukas in Valsad district under finger millet cultivation. Hence, we were purposively select 3 and 2 talukas from Dang and Valsad district, respectively by the purposive method. The market of Valsad and Dang was selected as this market is near to production area. To study marketing cost, margins and channels of marketing the no. of market functionaries viz., five hat bazar trader and 10 retailers were selected according to the major channel found in the marketing of finger millet by the respondents.

Cost of Marketing

The total cost incurred on marketing of finger millet by the farmers and the intermediaries involved in the process of marketing was calculated as,

$C = C_F + C_{m1} + C_{m2} + C_{m3}$ ----- $+ C_{mn}$

Where;

C = Total cost of marketing

C_F = Cost borne by the producer farmer in marketing of finger millet

C_{mi} = Cost incurred by the ith middleman in the process of marketing.

Marketing Margin

The absolute and percentage margin of middlemen involved in the marketing of finger millet was calculated as,

Absolute margin of ith middlemen $(A_{mi}) = P_{Ri} - (P_{pi} + C_{mi})$

Percentage margin of ith middleman =

$$\frac{P_{Ri} \quad (P_{Pi} \quad C_{mi})}{P_{Ri}} \quad 100$$

Where;

P_{Ri} = Sale price of the ith middlemen

P_{pi} = Purchase price of the ith middlemen; and

C_{mi} = Marketing cost incurred by i^{th} middlemen.

Price Spread

The producer's share, marketing costs and margins of different middle-men in the marketing of finger millet crop was worked out for the adopted channels using the formula:

$$Ps \quad \frac{P_f}{P_c} \quad 100$$

Where;

P_s = Producer's share in consumer's rupee

P_f = Price of the produce received by the farmer

P_c = Price of the produce paid by the consumer.

Constraints

The opinion of the respondents regarding the problems of production and marketing of finger millet were collected. Constraints of the farmer will be measured by Garrett's Ranking Technique**:**

$$\text{Percent position} = \frac{100\ (R_{ij} - 0.50)}{N_{ij}}$$

Where,

R_{ij} is the rank given by i^{th} item by j^{th} individual

N_j is the number of items ranked by the jth individual.

Marketing Channel

The difference between the price paid by the ultimate consumer and the price received by the farmer for the as equivalent quantity of produce is known as price spread. It includes the cost of performing various marketing function and margins of different agencies associated with the marketing process of the commodity. The extent of price spared helps policymakers in devising suitable policies for increasing marketing efficiency either by way of reducing the marketing costs or eliminating unwanted middlemen from the marketing process of by both. The marketing costs, margins, and price spared in the marketing of finger millet through major channel have been presented based on the data collected from farmers and market functionaries. The channels identified in the study area were:

Channel-I: Producer - Consumer

Channel-II: Producer - Retailer - Consumer

Channel-III: Producer - Local Mandi (Hat bazar) - Retailer - Consumer

RESULTS AND DISCUSSION

Valsad District

In northern Karnataka, the study was done on the marketing aspect of little millet and observed three different marketing channels. Among the different channels, the cost incurred was the highest in the Channel-IV (₹81.54/q) followed by Channel-III (₹73.11/q) and was the least in the case of Channel-I II (₹30.05/qtl) (Handigol *et al*., 2012). Total marketing cost was 18.57 percent and the total margin of intermediaries was 15.18 percent of consumer's price (Zala *et al.,* 2011). Net price received by producer was being ₹400 in Channel-II, which came to 74.90 percent to consumer price (Verma & Banafar, 2014).

The total cost incurred and margin earned along with price spread for different intermediaries is presented in Table 1. The percent share of total marketing cost was the highest in Channel-III (₹153.00) Followed by Channel-II (₹101.25) and Channel-I (₹53.75) which was 5.98, 4.61, and 2.89 percent respectively. The profit margin earned was the highest in Channel-III (₹580.00) which is 22.68 percent followed by Channel-II (₹260.00) which is 11.86 percent. The price spread was the highest Channel-III (₹733.00) followed by Channel-II (₹361.25).

Thus Channel - I more efficient compared to another channel.

Dang District

The study was done on Marketing of minor millets grown in tribal Dang district of South Gujarat and revealed that proportion of price spread was found highest in Kodra (31.15 percent) and the lowest in Vari (16.67 percent) and the market margin was ₹314.15, ₹277.40 and ₹152.15 per quintal in Vari, finger millet, and Kodra, respectively (Makadia *et al.*, 2014). The study revealed that channel II was more remunerative because farmer's share in consumer rupee was the highest (66.09 percent). The net share of commission agent was 1.37 percent. The net share of wholesaler was 1.72 percent share in consumer rupee. The net share of miller was 10.66 percent and the net share of the retailer was 2.38 percent. Price spread was maximum in Channel-I (35.73 percent) followed by Channel-II (33.91 percent) (Kaur *et al.,* 2013).

The total cost incurred and margin earned along with

Table 1. Price spread in marketing of finger millet in Valsad market

(₹)

	Channel-I	Channel-II	Channel-III
Producer's net price	1800 (97.10)	1830 (83.51)	1825 (71.34)
Cost incurred by			
Producer	53.75 (2.89)	53.75 (2.45)	56.75 (2.22)
Local mandi (Hat bazar)	-	-	45 (1.76)
Retailer	-	47.50 (2.16)	51.25 (2.00)
Total cost	53.75 (2.89)	101.25 (4.61)	153 (5.98)
Margin earned by			
Local mandi (Hat bazar)	-	-	280 (10.95)
Retailer	-	260 (11.86)	300 (11.73)
Total Margin	-	260 (11.86)	580 (22.68)
Consumer's price	1853.75 (100.00)	2191.25 (100.00)	2558 (100.00)
Price spread	-	361.25	733.00

Figures in parentheses indicate percent share in consumer's rupee.

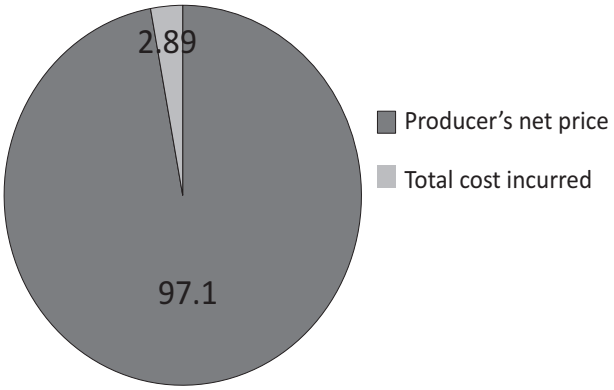


Figure 1. Price spread in Channel-I in marketing of finger millet in Valsad market

price spread for different intermediaries is presented in Table 2. The percent share of total marketing cost was the highest in Channel-III (V138.25) Followed by Channel-II (V90.25) and Channel-I (V51.50) which was 6.06, 4.53, and 2.94 percent respectively. The profit margin earned was the highest in Channel-III (₹510.00) which is 22.39 percent followed by Channel-II (₹250.00) which is 12.56 percent. The price spread was the highest Channel-III (₹648.25) followed by Channel-II (₹340.25). Thus Channel - I more efficient compared to other channel.

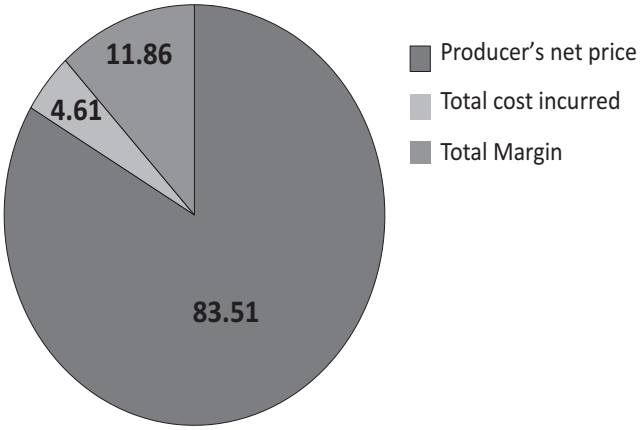


Figure 2. Price spread in Channel-II in marketing of finger millet in Valsad market

Table 2. Price spread in marketing of finger millet in Dang market

(₹)

	Channel-I	Channel-II	Channel-III
Producer's net price	1700 (97.05)	1650 (82.92)	1630 (71.55)
Cost incurred by			
Producer	51.50 (2.94)	50 (2.51)	52.25 (2.29)
Local mandi (Hat bazar)		40.25 (2.02)	39 (1.71)
Retailer			47.00 (2.06)
Total cost	51.50 (2.94)	90.25 (4.53)	138.25 (6.06)
Margin earned by			
Local Mandi (Hat bazar)		-	230 (10.10)
Retailer		250.00 (12.56)	280 (12.29)
Total Margin		250.00 (12.56)	510 (22.39)
Consumer's price	1751.50 (100.00)	1990.25 (100.00)	2278.25 (100.00)
Price spread	-	340.25	648.25

Figures in parentheses indicate percent share in consumer's rupee.

The analysis of price spread among the five identified channels indicates that the Channel-I was the most efficient because the producer's share was maximum that was 96.44 percent (Kumar, 2010).

Constraints

The marketing constraints analysis of farmers in the study area is represented in Table 3. Lack of transportation facility was ranked as the most important constraint

Table 3. Constraint analysis of farmers in finger millet marketing

Constraints	Mean score value	Garrett ranking
Lack of transportation facility	55.76	I
High cost of transportation	55.23	II
Inadequate market information	52.03	III
Fluctuation in market price	43.53	IV
Lack of storage facility	42.43	V

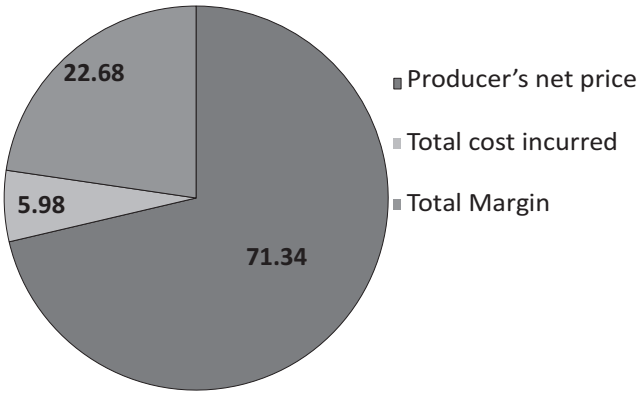


Figure 3. Price spread in Channel-III in marketing of finger millet in Valsad market

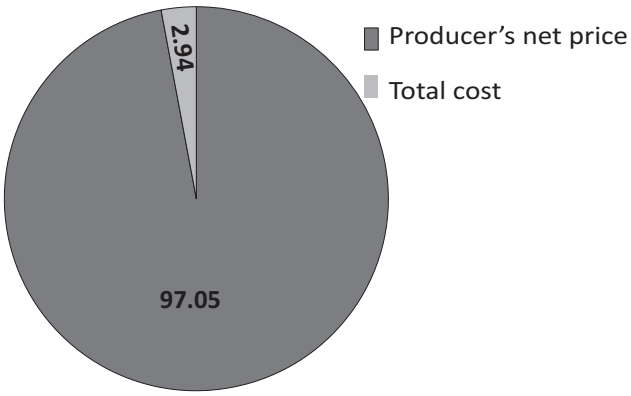


Figure 4. Price spread in Channel-III in marketing of finger millet in Dang market

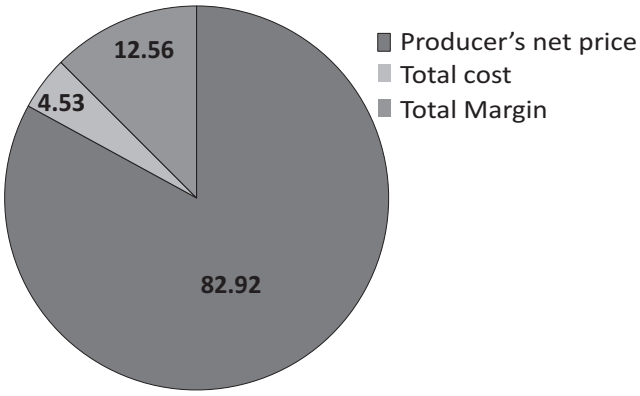


Figure 5. Price spread in Channel-II in marketing of finger millet in Dang market

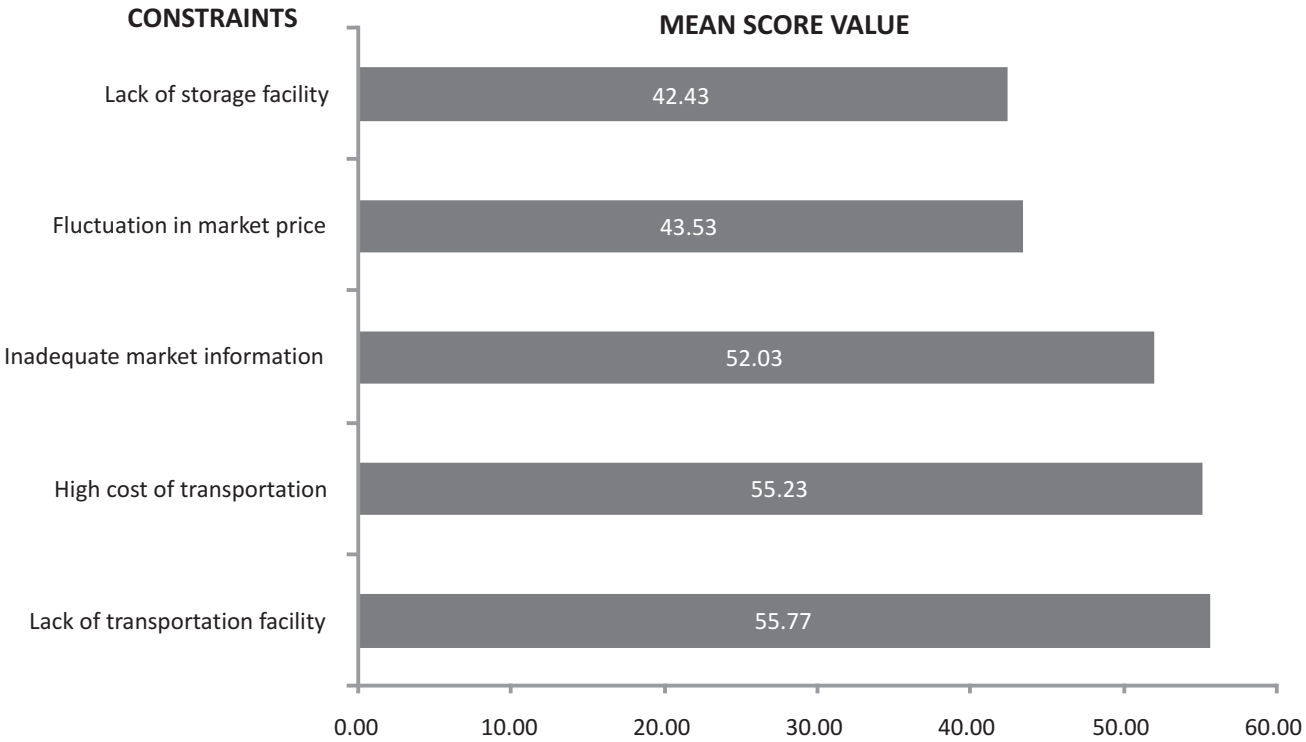


Figure 4. Constraints of finger millet marketing

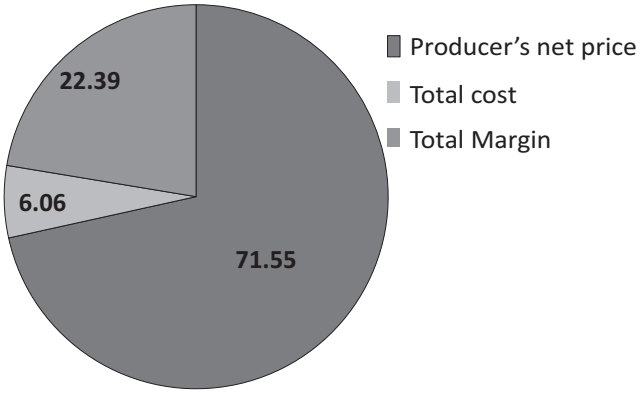


Figure 6. Price spread in Channel-III in marketing of finger millet in Dang market

(mean score value of 55.76) followed by high cost of transportation (mean score value of 55.23). Next major constraint reported was inadequate market information (mean score value of 52.03) in the study area. The other important constraints identified in the study area were fluctuation in market price (mean score value of 43.53) and lack of storage facility (mean score value of 42.43), *etc.*

The price fluctuation was the major problem in marketing of finger millet that is 56 percent followed by market information that is 45 percent (Venkataramana *et al*., 2015). The study on constraints in production and marketing of hybrid maize in Sarguja district of Chhattisgarh was carried out and the major constraints reported were lack of transit facilities that was 38percent followed by lack of storage facilities that was 20 percent (Mukherjee *et al.*,2015). The results showed that the land productivity had declined considerably in the region and low soil fertility was a major factor contributing to low productivity (Tenywa *et al.,* 1999).

CONCLUSIONS

In this study, there are three channels identified in the study area were: Channel-I: Producer - Consumer, Channel-II: Producer - Retailer - Consumer, Channel-III: Producer – Local mandi (Hat bazar) - Retailer – Consumer.

In Valsad district, producer received the price ₹1800 per quintal which is 97.10 percent of consumer's rupee in Channel-I. In Dang district, producer received the price of ₹1700 per quintal which is 97.05 percent of consumer's rupee in Channel-I. In Valsad district, producer received the price of ₹1830 per quintal which is 83.51 percent of consumer's rupee in Channel-II. In Dang district, producer received the price of ₹1650 per quintal which is 82.90 percent of consumer's rupee in Channel-II. In Valsad district, producer received the price of ₹1825 per quintal which is 71.34 percent of consumer's rupee in Channel-III. In Dang district, producer received the price of ₹1630 per quintal which is 71.55 percent of consumer's rupee in Channel-III.

In marketing, lack of transportation facility was ranked as the most important constraint (Rank-I) followed by high cost of transportation (Rank-II). The other important constraints identified in the study area were inadequate market information (Rank-III), fluctuation in market price (Rank-IV) and lack of storage facility (Rank-V), *etc.*

REFERENCES

Handigol, J.A., Yenagi, N.B., Ramacharya, V.A., Kumar, A., & Dolli, S.S. (2012). Economics of little millet marketing in Karnataka. *Indian Journal of Agricultural Marketing, 26*(2), 127-138.

Kaur, P.J., Singh, L.P., & Shirish, S. (2013). Production and marketing of basmati paddy in Hanumangarh district of Rajasthan. *Indian Journal of Agricultural Marketing, 27*(1), 59-65.

Kumar, V. (2010). A study on marketing cost, price spread, price behavior and marketing efficiency of groundnut in Rajasthan. *Indian Journal of Agricultural Marketing, 24*(2), 152-163.

Makadia, J.J., Patel, K.S., & Ahir, N.J. (2014). Marketing of minor millets grown in tribal Dang district of South Gujarat. *International Research Journal of Agricultural Economics and Statistics*, *5*(2), 197-200.

Mukherjee, A., Prusty, S.R., & Tripathy, S. (2015). Production and marketing of hybrid maize in Sarguja district of Chhattisgarh. *Indian Journal of Agricultural Marketing, 29*(1), 81-90.

Tenywa, J.S., Nyende, P., Kidoido, M., Kasenge, V., Oryokot, J., & Mbowa, S. (1999). Prospects and constraints of finger millet production in eastern Uganda. *African Crop Science Journal*, *7*(4), 569-583.

Venkataramana, M.N., Reddy, V.V., Dhananjaya P.S., & Kumar, H. (2015). Economic analysis of marketing channels and efficiency of marketing of finger millet (Ragi) in Karnataka. *International Research Journal of Agricultural Economics and Statistics*, *6*(1), 27-31.

Verma, P.K., & Banafar, K.N.S. (2014). Price spread of minor millets in Bastar district of Chhattisgarh. *Economic Affairs, 59*(2), 273-277.

Zala, Y.C., & Gondaliya, V.K. (2011). A study on marketing of paddy in middle Gujarat state. *Indian Journal of Agricultural Marketing, 25*(1):1-9.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 185-192
DOI: 10.5958/2322-0430.2018.00056.2

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Market Integration among Major Maize Markets in India

Navjot Kaur[1], Raj Kumar[1] and Ravneet Singh Brar[2]*

[1]*Department of Economics and Sociology, Punjab Agricultural University, Ludhiana -141004 (Punjab)*
[2]*Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana-141004 (Punjab)*

[*]*Corresponding author's email: navjotbhullar572@gmail.com*

Received: December 31, 2017 *Manuscript Number: NS-18-66* *Revision Accepted: February 15, 2018*

ABSTRACT
The study is based on secondary data which tests the price movement and integration between major national maize markets i.e. Hoshiarpur, S.B.S. Nagar, Nizamabad, Bangalore, Etah and international maize markets i.e. USA and Argentina. Weekly time series data on maize prices covering the period from 2012 to 2014 has been used for the study. To analyze the market integration among major maize markets, the Augmented Dickey-Fuller test, Johansen Co-integration test, and Granger Causality test were applied with the help of E-views statistical package. The results indicated the strong market integration in terms of price linkages among major maize markets. Out of the seven markets, six markets were found to be co-integrated. The results revealed that the national markets of maize have strong price linkages and thus are spatially integrated. It was further revealed from the analysis that, any disturbance in price will get corrected in about 8 hours in Argentina and 6 hours in USA markets, around 12 hours in Hoshiarpur market, 16 hours in S.B.S. Nagar market, 13 hours in Nizamabad market, 14 hours in Bangalore market and 12 hours in Etah market in short-run equilibrium. Hoshiarpur market prices influence the prices of S.B.S. Nagar and Nizamabad markets. Nizamabad and Bangalore market prices have a bidirectional influence. Similarly, Nizamabad and Etah market prices have a bidirectional influence. The transfer of price signals from one market to another helps in stabilizing the prices over space and create a healthy competitive environment. This would also help to protect the interest of producer-sellers. In order to achieve the goal of integration, the government should strengthen the market intelligence and communication within markets.

Keywords
Market integration, maize markets, stationarity, price transmission, time series.

JEL Codes
C01, C22, C32, D40, E37, M31, Q13.

INTRODUCTION

Maize is one of the most important cereals of the world and provides food for humans, feed for livestock and serves as a basic raw material for the production of starch, oil and protein, alcoholic beverages, food sweeteners and bio-fuel. Maize (*Zea mays L.*) is a versatile crop that adapts easily to a wide range of production environment. Some studies on the market co-integration provided evidence in favour of spatial integration of the regional food grain markets. Even though regional markets are geographically dispersed, prices across different market centers within and across states have exhibited long-run spatial linkages, suggesting that all the exchange locations are integrated and that prices provide relevant market signals. There are, however, regional variations in the extent of market integration, which could be due to regional disparities in infrastructure and the institutional structure of food grain markets (Ghosh, 2010; Sidhu *et al*., 2012, Burarak *et al.,* 2013). Analysis of market integration is viewed as a basic tool to understand how markets are linked (Zakari & Ying 2014). Lack of infrastructure, inadequate information flow, poor competition and inadequate marketing institutions are often major constraints to market integration in most developing countries. Lack of market integration is often associated with the issue of food insecurity due to the fact that there is no connection between markets to supply the deficit areas. The lack of timely and reliable market intelligence is yet to come up to the expectations to meet the growing needs of the farm

economy. Also, this lack of information has a negative influence on the marketing decision and efficient resource allocation thus barring the producers from gaining maximum benefits from the trade. Efficiency and performance of a market are influenced by market integration. Market integration is defined as the degree of price transmission between two either vertically or spatially related markets. Market integration not only provides valuable information about the working of wholesale food markets in developing countries but also helps to direct policy initiatives for ensuring efficiency (Mushtaq *et al.,* 2007).

It is very important to examine the spatial integration among major maize markets in the country as the results may have important implications for agricultural price policy. Thus, the knowledge of the spatial price relationship between markets is necessary for proper policy intervention. Therefore, in the present study, an attempt has been made to investigate, whether the national maize markets are spatially linked or not.

DATA AND METHODOLOGY

For the present study, five major maize markets were selected from different states of India, viz., Hoshiarpur (Punjab), S.B.S. Nagar (Punjab), Nizamabad (Andhra Pradesh), Bangalore (Karnataka) and Etah (Uttar Pradesh). Besides, two important international maize markets i.e. USA and Argentina were also selected. The weekly modal prices of maize were obtained from the Agricultural Produce Market Committees (APMC) for the markets of Punjab state and from the website of AGMARKNET for other selected national maize markets. The time series data of maize prices in the United States and Argentina markets were obtained from www.fao.org_.The data were collected for the period of April 2012 to March 2014. The data on prices used for the analysis refers to the modal price in a week. It is the price that occurs most frequently in a week and at which maximum quantity is transacted. Modal price is considered to be superior to the weekly average prices as it represents the major proportion of the commodity marketed during the week in a particular market. The different analytical techniques used in the study are described below.

Stationarity Test

To avoid spurious results, there is a need to check whether the time series is stationary or not. Therefore, testing the stationarity is a pre-requisite before analyzing any time series data. The co-integration among the variables requires checking the order of integration among variables which is not possible in the presence of unit root. E-views statistical package was used for this study. Augmented Dickey-Fuller (ADF) test was applied to test the stationarity in time series. The ADF test considers the null hypothesis that a given series has a unit root, i.e. it is non-stationary. The test is applied by running the regression in the following form:

$$Yt \quad a_0 \quad T \quad Y_{t\ 1} \quad a_1 \quad {}_{t\ 1}^{m} \quad Yt \quad 1$$

Where,

Yt = Price of commodity in a given market at time't'

$\Delta Yt = Y_t - Y_{t-1}$

Δ= Pure white noise error term

m = Optimal lag value which is selected on the basis of Schwartz Information Criterion (SIC)

The test for a unit root in the price series is carried out by testing the null hypothesis that β=0 that is the time series is non-stationary. The alternative hypothesis is that β is less than zero that is the time series is stationary. Once it was confirmed that either of two piece-series was stationary or of the same order of integration, the co-integration of markets were tested by Johansen maximum-likelihood techniques.

Johansen Co-integration Test

Cointegration explains the extent of deviation from the long run equilibrium relationship by the non-stationary series. In fact, cointegration is the link between integrated processes and steady-state equilibrium and hence provides the relevant theoretical framework for analyzing dynamics of instantaneous changes in a pair of series along with their valuable long-run information. After establishing that the price series are stationary and integrated of the same order, following Johansen & Juselius (1990) we have used cointegration test for the long run relationship among the price series The Johansen procedure examines a vector autoregressive (VAR) model of Yt, an (n×1) vector of variables that are integrated of order one. This VAR can be expressed as

$$Yt \quad {}_{i\ 1}^{p\ 1} \quad T_i Y_{t\ 1} \quad Y_{t\ 1} \quad t$$

Maximum likelihood ratio test statistics are proposed to test the number of cointegrating vectors.

$$J_{trace} \quad = -T \quad {}_{i\ r\ 1}^{n} \quad In\,(1 \quad \wedge i)$$

$$J_{max} \quad = -T \ln (1 - \Delta \wedge r)$$

The null hypothesis of at most r cointegrating vectors against a general alternative hypothesis of more than r cointegrating vectors is tested by trace statistics. The null hypothesis of r cointegrating vector against the alternative hypothesis of r+1 is tested by Maximum Eigen-value statistic (Hjalmarsson & Osterholm, 2010). The number of cointegrating vectors indicated by the tests is an important indicator of the extent of co-movement of prices. An increase in the number of co-integrating vectors implies an increase in the strength and stability of price linkages.

Granger Causality Test

The causal relationship between the prices series in important maize markets was approached through Granger's causality technique (Grangner, 1969).The Granger causality test conducted within the framework of a vector autoregressive (VAR) model is used to test the existence and direction of long-run causal price relationship between the markets. An autoregressive

distributed lag (ADL) model for the Granger-causality test is specified as below:

$$P_t^i \quad {}_0 \quad {}_{j\ 1}^{j} \quad jP_t^1{}_j \quad {}_{k\ 1}^{k} \quad hkP_t^2{}_k \quad t$$

Where t is the time period,

Δt is the error term,

P^1 and P^2 are the prices in the two markets at time t.

j and k are the numbers of lags of both the variables in the system respectively.

The Granger test is based on a premise that if forecasts of some variable, say X, obtained by using both the past values of X and the past values of another variable Y, is better than the forecasts obtained using past values of X alone, Y is then said to cause X.

$$Y_i = a_i Y_{t-i} + b_i X_{t-i+} e_i \quad \text{.....} (1)$$

$$X_i = c_i Y_{t-i} + d_i X_{t-i} + v_i \text{.....} (2)$$

Where X_i and Y_i are two stationary time series with zero mean; e_i and v_i are two correlated series. Since the non-stationary series of the variable is usually integrated of order I (1), first difference of the variable is normally taken which makes the series stationary. The optimal lag length of the variables is determined by minimizing Akaike's Information Criterion. Based on equations 1 and 2, unidirectional causation from one variable X to Y (X Granger causes Y) is observed if the variable in equation 1 is statistically non-zero as a group and the set of lagged Y coefficient is zero in equation 2. Similarly, unidirectional causation from Y to X (Y Granger causes X) is implied if the estimated coefficient on the lagged Y in equation 2 is statistically different from zero as a group and the set of estimated coefficient on the lagged X variable in equation 1 is not statistically different from zero. Feedback or mutual causality (bi-directional) would occur when the set of the coefficient on the lagged X variable in equation 1 and on lagged variable Y in equation 2 are statistically different from zero. Finally, independence exists when the coefficients of both X and Y variables are equals to zero.

Vector Error Correction Method (VECM)

If price series are stationary at first difference, then one could run regressions in their first differences. However, by taking first differences, the long-run relationship that stored in the data is being lost. This implies that one needs to use variables in levels as well. An advantage of error correction methodology is that it incorporates variables both in their levels and first differences. By doing this, this method captures the short-run disequilibrium situations as well as the long-run equilibrium adjustments between prices. VECM can incorporate such short-run and long-run changes in the prices movements. A generalized VECM formulation to understand the short run and long-run behavior of prices can be considered by first taking the autoregressive distributed lag (ADL) equation as follows:

$$Y_t = \alpha_{01} X_t + a_{1i} X_{t-1} + a_{12} Y_{t-1} + \varepsilon_t$$

$$\Delta Y_t = a_0 \Delta X_t + (1 - a_{12}) \quad \frac{(a_{01} \quad a_{11})}{(1 \quad a_{12})} x_{t\ 1} \quad y_{t\ 1} \quad {}_1$$

The generalized form of this equation for k lags and an intercept term is as follows:

$$Y_t \quad a_{00} \quad {}_{i\ 0}^{k\ 1} a \ X_{t\ i} \quad {}_{i\ 1}^{k\ 1} a \ Y_{t\ i} \quad m_0 [m_1 X_{t\ k} \quad {}_k Y_{t\ k}] \quad {}_t$$

$$where \ , mo \quad (1 \quad {}_{i\ 1}^{k} ai_2) and m_1 \quad \frac{a_{i1}}{{}_{i\ 0} m_0}$$

The parameter m_o measures the rate of adjustment of the short-run deviations towards the long run equilibrium. Theoretically, this parameter lies between zero and one. The value zero denotes no adjustment and indicates an instantaneous adjustment. A value between zero and one indicates that any deviations will have a gradual adjustment to the long-run equilibrium values.

RESULTS AND DISCUSSION

Results of Augmented Dickey-Fuller (ADF) test

Augmented Dickey-Fuller test (ADF) was applied to check whether the price series of maize is stationary at their level or at first difference. The results presented in Table 1 indicate that the price series has unit root in Hoshiarpur market (Punjab), S.B.S. Nagar market (Punjab), Nizamabad market (Andhra Pradesh), Bangalore market (Karnataka), Etah market (Uttar Pradesh) and international markets of USA and Argentina. Therefore it could be inferred that at a level all the price series are non-stationary. All the price series of the selected maize markets become stationary at their first difference as the ADF values for all the markets are more than that the critical value (1 percent).

Results of Johansen Co-integration Test

Based on the Johansen multiple co-integration procedures, co-integration between the markets was analyzed using E-Views software. Unrestricted co-integration rank tests (Trace and Maximum Eigenvalue) indicated the presence of at least 6 co-integrating equations at percent level of significance, thus revealing that most of the selected maize markets were having long-run equilibrium relationship. The results are presented in Table 2.

Results of Granger Causality Test

The causal relationship between the price series in major maize markets was approached through Granger Causality technique. The results of the analysis showing the relationship between major maize markets are presented in Table 3 and Figure 1.

From the analysis the observed directions of price signals among the selected maize markets are given as under:

Hoshiarpur market prices influence the prices at S.B.S. Nagar market and not vice-versa.

Hoshiarpur market prices influence the prices at Nizamabad market and not vice-versa.

Bangalore market prices influence the prices at Hoshiarpur market and not vice-versa.

S.B.S. Nagar market prices influence the prices at Nizamabad market and not vice-versa.

S.B.S. Nagar market prices influence the prices at Bangalore market and not vice-versa.

Nizamabad and Bangalore market prices have a bidirectional influence.

Nizamabad and Etah market prices have a bidirectional influence.

Bangalore market prices influence the prices at Etah market and not vice-versa.

USA market prices influence the prices at Argentina market and not vice-versa.

Results of Vector Error Correction Model

Since the maize markets are integrated into the long run, it is important to study the short run and long run equilibrium among the markets. Hence, Vector Error Correction Model (VECM) was employed to know the speed of adjustments among the markets for long-run equilibrium and results of the same presented in Table 4. The error correction term indicates the speed of adjustment among the variable before converging to equilibrium in the dynamic model. The coefficients show how quickly variables return back to equilibrium. The Table 4 clearly shows that the co-integration equation of error correction mechanism is significant in all the seven markets. It is revealed from the analysis that, any disturbance in price will get corrected in about 8 hours in Argentina and 6 hours USA markets, around 12 hours in Hoshiarpur markets, 16 hours in S.B.S. Nagar markets, 13 hours in Nizamabad markets, 14 hours in Bangalore market, 12 hours in Etah market. In all the selected markets, the prices were influenced by their own weekly lags for long-run equilibrium. In addition, in the long run, the price changes in S.B.S. Nagar market are influenced by one week back prices of Hoshiarpur market to the extent of 5 percent, while one-week lag prices of maize in Hoshiarpur market influence the present market prices of Nizamabad market to the extent of 57 percent. In the third week, lag prices of maize in Hoshiarpur market influence the present market prices of S.B.S. Nagar and Nizamabad market to the extent of 43, and 38 percent respectively. In Hoshiarpur market, the prices are influenced to the extent of 59, 48, and 29 percent by its own one-week lag price, second-week lag price and third-week lag price respectively. The price changes in Nizamabad market are influenced by one-week lag prices of S.B.S. Nagar market to the extent of 92 percent. The price changes in Nizamabad market are influenced by second-week lag prices of S.B.S. Nagar market to the extent of 67 percent. The price changes in Nizamabad market are influenced by third-week lag prices of S.B.S. Nagar market to the extent of 57 percent. The price changes in Bangalore market are influenced by second-week lag prices of S.B.S. Nagar

Table 1. ADF test results of maize price series in the selected national and international markets

Markets	At level	Stationarity	At first difference	Stationarity	Critical values
Hoshiarpur	-2.852488	Non-stationary	-6.919654***	Stationary	-4.051450 (at 1 percent level)
S.B.S. Nagar	-2.936011	Non-stationary	-8.568852***	Stationary	
Nizamabad	-2.748446	Non-stationary	-7.115738***	Stationary	
Bangalore	-2.163435	Non-stationary	-9.590070***	Stationary	
Etah	-2.109952	Non-stationary	-7.984018***	Stationary	
USA	-0.865655	Non-stationary	-6.584408***	Stationary	
Argentina	-1.402041	Non-stationary	-6.975017***	Stationary	

****** Significance at one percent level.***
Null Hypothesis: Series has a unit root.

Table 2. Results of Johansen Co-integration Analysis

Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	Critical value (0.05)	p**
None *	0.523584	229.3257	150.5585	0.0000
At most 1 *	0.437703	156.6623	117.7082	0.0000
At most 2 *	0.250957	100.2413	88.80380	0.0058
At most 3 *	0.223888	71.92336	63.87610	0.0090
At most 4 *	0.191664	47.08444	42.91525	0.0181
At most 5 *	0.152414	26.23224	25.87211	0.0451
At most 6	0.097253	10.02664	12.51798	0.1260

Trace test indicates 6 co-integrating markets (s) at the 0.05 level.
****denotes rejection of the hypothesis at the 0.05 level.***
*****Mackinnon-Haug-Michelis (1999) p-values.***

market to the extent of 21 percent. The price changes in Bangalore market are influenced by third-week lag prices of S.B.S. Nagar market to the extent of 12 percent. The prices of Etah, US, and Argentina markets are influenced by one-week lag prices of Nizamabad market prices to the extent of 17, 11, and 8 percent respectively. The prices of Etah, US, and Argentina markets are influenced by second-week lag prices of Nizamabad market prices to decrease the extent of 13, 7, and 7 percent respectively. The price changes in Hoshiarpur market are influenced by one week back prices of Bangalore market to the extent of 7 percent while it decreased in second lag prices of maize in Bangalore market influence the present market prices of Hoshiarpur markets to the extent of 4 percent. The price

Table 3. Results of pair-wise granger causality test results

Null Hypothesis:	Observations	F-Statistic	Probability
NW does not Granger Cause HS	101	0.88549	0.4159
HS does not Granger Cause NW		3.24496	0.0433
NZ does not Granger Cause HS	101	2.15090	0.1220
HS does not Granger Cause NZ		3.32261	0.0402
BG does not Granger Cause HS	101	8.38452	0.0004
HS does not Granger Cause BG		0.51402	0.5997
NZ does not Granger Cause NW	101	0.36324	0.6964
NW does not Granger Cause NZ		4.84749	0.0099
BG does not Granger Cause NW	101	0.53566	0.5870
NW does not Granger Cause BG		4.05154	0.0205
BG does not Granger Cause NZ	101	4.19495	0.0179
NZ does not Granger Cause BG		7.63855	0.0008
ET does not Granger Cause NZ	101	0.77893	0.0418
NZ does not Granger Cause ET		2.81600	0.0648
ET does not Granger Cause BG	101	0.58409	0.5596
BG does not Granger Cause ET		7.02157	0.0014
AR does not Granger Cause US	101	0.80123	0.4518
US does not Granger Cause AR		3.20672	0.0449

Price series HS-Hoshiarpur, SBS-S.B.S. Nagar, NZ-Nizamabad, BG-Bangalore, ET-Etah, US-USA, and AR-Argentina.

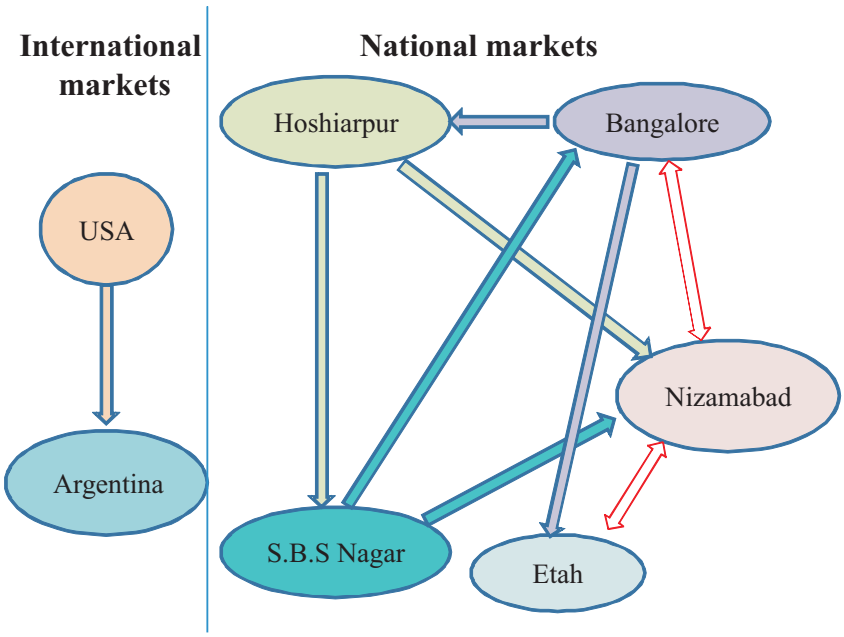


Figure. 1. Market integration among major national and international maize markets

Table 4. Results of vector error correction model

Error correction	D (HS)	D (SBS)	D (NZ)	D (BG)	D (ET)	D (US)	D (AR)
CointEq1	2.67E-05	0.097671	-0.0749480	0.081534	0.068985	-0.049024	-0.036465
	(0.12273)	(0.16819)	(0.12051)	(0.12814)	(0.04923)	(0.02048)	(0.01618)
	[0.00022]	[0.58070]	[-6.21939]	[0.63629]	[1.40132]	[-2.39335]	[-2.25313]
D (HS(-1))	-0.592398	0.049394	0.568735	-0.052702	-0.073183	0.035675	0.013597
	(0.17622)	(0.24150)	(0.17303)	(0.18399)	(0.07068)	(0.02941)	(0.02324)
	[-3.36174]	[2.20453]	[3.28695]	[-0.28644]	[-1.03536]	[1.21297]	[0.58514]
D (HS(-2))	-0.482020	0.247256	0.276165	-0.149961	-0.070266	0.030720	-0.000936
	(0.16925)	(0.23195)	(0.16618)	(0.17671)	(0.06789)	(0.02825)	(0.02232)
	[-2.84800]	[1.06600]	[1.66180]	[-0.84862]	[-1.03503]	[1.08753]	[-0.04193]
D (HS(-3))	-0.292362	0.433329	0.382497	-0.071633	-0.042377	0.040388	0.016905
	(0.16441)	(0.22532)	(0.16143)	(0.17166)	(0.06595)	(0.02744)	(0.02168)
	[-1.77825]	[1.92320]	[2.36938]	[-0.41729]	[-0.64259]	[1.47187]	[0.77973]
D (SBS(-1))	0.107109	-1.285662	0.923993	-0.164114	-0.079313	0.053980	0.049976
	(0.17140)	(0.23490)	(0.16830)	(0.17896)	(0.06875)	(0.02861)	(0.02260)
	[0.62491]	[-5.47333]	[5.49024]	[-0.91705]	[-1.15362]	[1.88696]	[1.21106]
D (SBS(-2))	0.098274	-1.126511	0.674522	-0.205118	-0.086277	0.051515	0.044187
	(0.18620)	(0.25517)	(0.18282)	(0.19440)	(0.07469)	(0.03108)	(0.02455)
	[0.52780]	[-4.41472]	[3.68945]	[-2.05511]	[-1.15519]	[1.65770]	[1.79961]
D (SBS(-3))	0.118595	-0.761773	0.572268	-0.121074	-0.071445	0.033086	0.025934
	(0.18309)	(0.25091)	(0.17977)	(0.19116)	(0.07344)	(0.03056)	(0.02414)
	[0.64774]	[-3.03598]	[3.18325]	[-2.63336]	[-0.97284]	[1.08274]	[1.07415]
D (NZ(-1))	0.140505	-0.088236	0.803787	-0.174839	-0.170010	0.112826	0.076297
	(0.29238)	(0.40070)	(0.28709)	(0.30527)	(0.11728)	(0.04880)	(0.03856)
	[0.48055]	[-0.22021]	[2.79977]	[-2.57273]	[-2.44962]	[2.31206]	[1.97884]
D (NZ(-2))	0.166049	-0.114590	0.649096	0.118261	-0.135018	0.086775	0.070923
	(0.23206)	(0.31803)	(0.22786)	(0.24229)	(0.09308)	(0.03873)	(0.03060)
	[0.71554]	[-0.36031]	[2.84865]	[2.48809]	[-2.45050]	[2.24045]	[2.31761]
D (NZ(-3))	0.032096	-0.078820	0.573441	0.209667	-0.099670	0.059857	0.044996
	(0.19425)	(0.26621)	(0.19074)	(0.20282)	(0.07792)	(0.03242)	(0.02562)
	[0.16523]	[-0.29608]	[3.00648]	[1.03378]	[-1.27918]	[1.84625]	[1.75658]
D (BG(-1))	0.072924	0.085764	0.126720	-1.071579	0.000702	-0.019048	-0.008489
	(0.11961)	(0.16392)	(0.11744)	(0.12488)	(0.04798)	(0.01996)	(0.01577)
	[2.60968]	[0.52321]	[1.07898]	[-8.58060]	[0.01463]	[-0.95419]	[-0.53817]
D (BG(-2))	0.411433	0.140880	0.038173	-1.149350	-0.219284	-0.008780	-0.002039
	(0.16735)	(0.22935)	(0.16432)	(0.17473)	(0.06713)	(0.02793)	(0.02207)
	[2.45851]	[0.61427]	[2.23231]	[-6.57787]	[-3.26670]	[-0.31435]	[-0.09239]
D (BG(-3))	0.373204	-0.034938	0.039330	-0.825141	-0.220768	0.016413	0.014414
	(0.19986)	(0.27390)	(0.19624)	(0.20867)	(0.08017)	(0.03336)	(0.02636)
	[1.86732]	[-0.12756]	[0.20042]	[-3.95423]	[-2.75384]	[0.49205]	[0.54689]
D (ET(-1))	0.287596	-0.483099	0.155236	0.186606	-0.738963	0.083964	0.079907
	(0.29071)	(0.39841)	(0.28545)	(0.30353)	(0.11661)	(0.04852)	(0.03834)
	[0.98927]	[-1.21257]	[0.54382]	[0.61478]	[-6.33704]	[1.73050]	[2.08436]

Cont...

D (ET(-	0.230325	-0.801065	0.917362	0.379855	-0.705565	0.062950	0.101351
	(0.34428)	(0.47182)	(0.33805)	(0.35946)	(0.13810)	(0.05746)	(0.04540)
	[0.66900]	[-1.69782]	[2.71370]	[1.05674]	[-5.10923]	[1.09554]	[2.23238]
D (ET(-3))	0.479889	-0.662674	1.004021	0.413145	-0.676738	0.059661	0.037332
	(0.39161)	(0.53668)	(0.38452)	(0.40888)	(0.15708)	(0.06536)	(0.05164)
	[1.22543]	[-1.23476]	[2.61111]	[1.01044]	[-4.30823]	[0.91282]	[0.72291]
D (US(-1))	2.042606	-1.424904	-0.269677	0.544229	-0.179941	-0.664048	0.146486
	(1.07346)	(1.47113)	(1.05403)	(1.12079)	(0.43058)	(0.17916)	(0.14156)
	[1.90282]	[-0.96858]	[-0.25585]	[0.48557]	[-0.41790]	[-3.70642]	[2.03481]
D (US(-2))	2.924163	-1.625428	-0.387965	1.378848	-0.157158	-0.507206	0.239399
	(1.27595)	(1.74863)	(1.25285)	(1.33221)	(0.51180)	(0.21296)	(0.16826)
	[0.29176]	[-0.92955]	[-0.30967]	[1.03501]	[-0.30707]	[-2.38174]	[4.42280]
D (US(-3))	2.801079	-0.660575	0.187337	2.668114	-0.386402	-0.754316	-0.093429
	(1.39567)	(1.91270)	(1.37041)	(1.45721)	(0.55982)	(0.23294)	(0.18405)
	[0.00698]	[-0.34536]	[0.13670]	[1.83098]	[-0.69022]	[-3.23827]	[-2.50763]
D (AR(-1))	-1.378355	3.197968	-3.958445	-0.562377	0.170638	-0.125746	-0.971164
	(1.45431)	(1.99306)	(1.42798)	(1.51843)	(0.58334)	(0.24272)	(0.19178)
	[-0.94778]	[1.60455]	[-1.77206]	[-0.37037]	[0.29252]	[-1.51806]	[-5.06396]
D (AR(-2))	-1.693592	4.343553	-3.292024	-1.679745	0.792851	-0.154008	-0.739013
	(1.79537)	(2.46047)	(1.76287)	(1.87453)	(0.72015)	(0.29965)	(0.23676)
	[-0.94331]	[1.76533]	[-1.86742]	[-0.89609]	[1.10095]	[-0.51396]	[-3.12141]
D (AR(-3))	-1.516663	0.276722	-2.348386	-3.902756	0.804525	0.229215	-0.128443
	(1.92910)	(2.64374)	(1.89417)	(2.01416)	(0.77379)	(0.32197)	(0.25439)
	[-0.78620]	[0.10467]	[-1.23979]	[-1.93766]	[1.03972]	[1.71192]	[-2.50491]
R-squared	0.577730	0.747708	0.788441	0.695900	0.640638	0.610883	0.681243
Adj. R-	0.324367	0.596332	0.661506	0.513441	0.425021	0.377412	0.489988
Sum square residue	273767.0	514173.5	263945.3	298442.0	44047.40	7625.994	4760.751
S.E. equation	67.54838	92.57191	66.32563	70.52682	27.09471	11.27386	8.907629
F-statistic	2.280252	4.939425	6.211367	3.813995	2.971182	2.616530	3.561969
Log-	-522.9851	-553.5539	-521.2132	-527.1706	-434.3751	-349.3205	-326.4694
Akaike AIC	11.54609	12.17637	11.50955	11.63238	9.719074	7.965371	7.494213
Schwarz SC	12.52819	13.15848	12.49166	12.61449	10.70118	8.947477	8.476320
Mean	0.250103	0.824948	-0.673505	-0.092887	-0.085567	0.113711	0.082474
S.D.	82.17877	145.7026	114.0003	101.1082	35.73209	14.28803	12.47303

Figures in parentheses ( ) indicate the standard errors and the figures in parentheses [] indicate 't' statistics.
(-1), (-2) and (-3) indicate number of lags.
Price series: HS-Hoshiarpur, SBS-S.B.S. Nagar, NZ-Nizamabad, BG-Bangalore, ET-Etah, US-USA, AR-Argentina.

changes in Nizamabad market are influenced by second week back prices of Bangalore market to the extent of 4 percent; while in third lag prices of maize in Bangalore market influence the present market prices of Nizamabad markets to the extent of 4 percent.

The price changes in Etah market are influenced by second week back prices of Bangalore market to the extent of 22 percent while in third lag prices of maize in Bangalore market influence the present market prices of Etah markets to the extent of 22 percent. The price changes in Argentina market are influenced by one week back price of Etah market to the extent of 8 percent while second-week lag prices of maize price in the Etah market influence the present market price of Argentina market to the extent of 10 percent. The price changes in Nizamabad market are influenced by second week back price of Etah market to the extent of 92 percent while third-week lag prices of maize price in the Etah market influence the present market price of Nizamabad market to the extent of 100 percent. In USA market, the prices are influenced by its own one-week lag price to the extent of 66 percent. In USA market, the prices are influenced by its own second-week lag price to the extent of 51 percent. In USA market, the prices are influenced by its own one-week lag price to the extent of 75 percent. The price changes in Argentina market are influenced by one week back price of USA market to the extent of 15 percent while second-week lag prices of

maize price in the USA market influence the present market price of Argentina market to the extent of 24 percent. In third-week lag prices of maize price in the USA market influence the present market price of Argentina market to the extent of 9 percent.

CONCLUSIONS

The Hoshiarpur, S.B.S. Nagar, Nizamabad, Bangalore, Etah markets were co-integrated in terms of weekly wholesale prices which indicated that the price movements of maize lead to the stability of space. The transfer of price signals from one market to another helps in stabilizing the prices over space and create a healthy competitive environment. The knowledge on market integration is necessary to understand the efficiency of the marketing system. This would also help to protect the interest of producer-sellers.

REFERENCES

Burarak, S.S., Sharma, H., & Meena, G.L. (2013). Market integration and price volatility in domestic markets of coriander in Rajasthan. *Indian Journal of Agricultural Marketing, 27*, 121-131.

Ghosh, M. (2010). Spatial price linkages in regional food grain markets in India. *Margin: The Journal of Applied Economic Research, 4*, 495-516.

Grangner, C.W.J. (1969). Investing causal relations by econometric models and cross-spectral methods. *Econometrica*, *37*, 424-438.

Hjalmarsson, E., & Osterholm, P. (2010). Testing for cointegration using the Johansen methodology when variables are near integrated. *Empirical Economics*, *39*, 51-76.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration-With applications to the demand for money. *Oxford Bulletin of Economics and Statistics, 52*, 169-210.

Mushtaq, K., Abbas, F., & Abeddulah (2007). Government interventions and market integration in prominent wheat markets of Pakistan. *Pakistan Journal of Agricultural Sciences*, *44*, 356-360.

Sidhu, J.S., Singh, J., Kumar, R., Pal, G., Singh, L., Ajjan, N., & Raveendaran, N. (2012). *Commodity report: Wheat.* Research Report (Pp 63-78). Department of Economics and Sociology, PAU, Ludhiana, India. .

Zakari, S., & Ying, L. (2014). Measuring spatial integration in Niger grain markets. *Journal of Agricultural Science, 6*, 15-23.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 193-197
DOI: 10.5958/2322-0430.2018.00057.4

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Consumer Perspective on Green Agricultural Marketing Practices

Poulami Mukherjee[1] and Sanica Abbott[2]*

[1]*Student, and* [2]*Assistant Professor, Amity School of Economics, Amity University, Sector-125, Noida-201313 (Uttar Pradesh)*

[*]*Corresponding author's email: poulamimukherjee22@gmail.com*

Received: December 31, 2017 *Manuscript Number: NS-18-69* *Revision Accepted: February 23, 2018*

ABSTRACT

The research paper sets out to examine the awareness level and willingness of consumers to adopt green products and green marketing practices. Both these aspects have been amply researched and analyzed in detail and presented in a very lucid manner. The way forward from the perspective of producers/manufactures, marketing agencies and consumers has been laid out in detail. It is pertinent to mention that governments at all levels have a major role to play in ensuring that the necessary changeover to green products & practices happens in a desirable manner.

Keywords

Agriculture, consumer economics, marketing, multiple regression.

JEL Codes

C20, D12, M31, O13.

INTRODUCTION

Green Marketing has emerged as the latest trend in marketing all over the world in recent times. A large number of studies have been conducted worldwide to gauge the preferences of public as far as green marketing is concerned. It is therefore prudent to analyze the concept of green marketing in relation to agricultural produce in India.

Green marketing in agricultural produce would cover the entire cycle from farm to fork in its entirety. Commencing with the preparation of soil without resorting to use of chemicals, using only natural ingredients for rejuvenating soil, utilizing only green practices to ensure proper ecological balance, using drip irrigation to conserve water and using only bio-manures would all constitute green practices as long as they minimize the use of resources. Utilizing vermicomposting instead of synthetic fertilizers, crop rotation, companion planting and biological pest control all contribute to green agricultural practices. Going further in the process of growing crops and ensuring that such produce reaches the dining tables of the people in an environmentally friendly and sustainable manner is the biggest challenge.

Customers nowadays are concerned about how their usage of any product and services affects the environment, positively or negatively, whether it is degrading the environment or not. The increasing water and air pollution, global warming and the changes in the climate are of concern to a very large cross-section of population. Green marketing of agricultural produce if adopted by various organizations will give them an opportunity to meet the expectations of such customers addressing their concerns about environment. In a survey conducted by "National Geographic Society" and the international polling firm Globescan (2014) have determined the green attitude of the consumers through the *Consumer Greendex*. Consumers scoring the highest were majorly from the developing countries such as China, Brazil and India. Consumers from the industrialized countries scored low or were placed at the bottom. Consumers from United States, Russia and India showed most considerable increase towards being environmentally friendly and having most sustainable behaviour (Howe *et al*., 2010).

Governments at all levels and industry are working towards changing the preferences of the public to adopt environmentally sustainable products and practices. The judiciary has also been compelling changes in usage of environmentally friendly products & practices. Use of

plastic carry bags, controlling pollution of rivers, generating solar & wind power to reduce dependence on fossil fuels and switching over to CNG instead of diesel fuel are specific cases that stand out.

The government of India is working towards helping farmers market their certified produce through Agricultural and Processed Food Products Export Development Authority (APEDA). APEDA has tied up with Metal and Scrap Trading Corporation to start a platform – e-organic bazaar portal – from January 2018 to help farmers sell their produce and ensure certified produce to traders and companies.

Presently it is slightly expensive to adopt green agricultural produce marketing practices. The connected ecosystem is yet to mature to provide economies of scale and bring down prices of products within acceptable limits to consumers. It is therefore extremely important that awareness is created amongst consumers about green marketing practices so that more and more people switch over to the green & sustainable preferences, the volumes increased would bring down prices for green products and practices. Keeping in mind the significance of green marketing practices in the current era the study was undertaken with the following objectives to analyze the consumer behaviour and perceptions towards it:

i. Awareness of the consumers regarding Green Marketing Practices,
ii. Quantifying the green values of the consumers living in UP,
iii. Issues and challenges of Green Marketing Practices,
iv. Consumer preferred brands for Green Marketing, and
v. Factors motivating the consumers to buy Green Products.

Literature Review

Polonsky (1994) stated the definition of green marketing as a marketing strategy which consists of all activities designed to generate and facilitate any exchanges intended to satisfy human needs or wants, such that the satisfaction of these needs and wants occurs, with minimal detrimental impact on the natural environment.

Jain & Kaur (2004) discussed that business firms started responding to environmental challenges by practicing green marketing strategies. Green consumerism has played a catalytic role in ushering corporate environmentalism and making business firms green marketing oriented. Based on the data collected through a field survey, the paper made an assessment of the extent of environmental awareness, attitudes, and behaviour prevalent among consumers in India.

Priya (2015) revealed that in agriculture sector more emphasis must be given to organic agriculture from seed sowing to harvesting and thereafter post-harvest and packaging which could be attained by having proper checkpoints at all stages like use of quality seeds without treatment with chemicals, more use of biocontrol agents, farmyard manure, straw mulches, processing without chemical treatment, quality packaging materials and on time marketing.

Tiwari (2014) stated some suggestions to organizations for catering challenges of green marketing and successful exploitation of green marketing like awareness of merits of green products to be increased and awareness of the environmental threats. Consumers must be motivated to switch brands or even pay a premium for the greener alternative.

Welling & Chavan (2010) revealed that green marketing can initially be a costly thing to undertake and there will be several issues regarding this and challenging for the producers but it can be worked out if they seriously want to work for the protection of the environment. Renfro (2010) stated that green product practices can lead to an increase in the consumer base and can also help the companies to have a competitive advantage.

RESEARCH METHODOLOGY

The study is based on critical evaluation and analysis of Primary Data. Data had been collected from the sample respondents on the pre-structured schedule by a personal interview method. Selection was based on random sampling technique. 101 consumers had been selected from Uttar Pradesh for the analysis. Haws *et al.* (2010) had developed a green consumer value scale which was adopted in this study. The respondents were asked to fill the questionnaire and rate the given statements on a 5 point scale ranging from agreement to disagreement. As the neutral point on the scale was 3 and thus the mean results above 3 suggests overall agreement and below 3 represents overall disagreement. To analyze the data simple statistical tools had been used like mean, standard deviation and Multiple Regression analysis is also used. Multiple regression analysis is used to explain the relationship between one dependent variable and two or more independent variables. The following models have been used for this study:

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + u$

Where Y = Purchase behaviour

X_1 = Awareness

X_2 = Green Practices

X_3 = Green Values

In this model purchase behaviour is the dependent variable and awareness, green practices and green values represent the independent variables.

$Z = \alpha_0 + \alpha_1 W_1 + \alpha_2 W_2 + v$

Where Z = Green Values

W_1 = Age

W_2 = Gender

In this model Green values is the dependent variable and age and gender are the independent variables. Cronbach Alpha was used to find the reliability analysis of the Green Consumer Values by taking into account the green value statements.

DATA ANALYSIS

Awareness

According to the survey conducted majority of the

respondents were aware of the green marketing ventures and the green products prevailing in the society. But the noticeable thing was that even though they knew about the green marketing ventures, they were not much aware about the initiatives taken up by the central and state governments of the country for the protection of the environment. The NGOs have also contributed in green marketing practices but even their works and initiatives are not known to a majority of the consumers. There is a strong need for dissemination of information about the initiatives undertaken by different agencies to the ultimate consumer.

RESULTS AND DISCUSSION

Sources of Information

The perusal of Table 1 indicates the sources of information from which the consumers get the information about green marketing for the sample respondents. As high as 60.4 percent consumers have reported that internet was their main source of information about green marketing followed by media with the second highest percentage (13.9). Similarly, 9.9 percent sample respondents claimed their source of information regarding Green Marketing Practices was their family members and the rest 8.9 percent through television and ads. Thus from the above analysis, we can state that the consumers have got the maximum information from internet and through media about Green Marketing Practices.

Consumer Perception about Green Products

The green marketing practices are extremely important and the consumers also strongly agree to this and have also rated the production in eco-friendly manner as one of the most important practice to make green marketing successful. None of the green marketing practices have had a mean score below 4 (Table 2). Hence we can state that all of the green marketing practices have some relevance for consumers for the protection of the environment and preservation of its resources. Using eco-friendly modes of communication for the promotion of products has the highest mean score of 4.66 and hence is the most important green marketing practices according to the consumers as per the survey conducted. Manufacturing eco-friendly products had a mean of 4.32, educating the consumers regarding the use of environment-friendly products had a mean of 4.46, and lastly, green marketing practices in association with branding the product had a mean of 4.20 (Table 2).

The green marketing practices statements, their respective mean scores and standard deviation value shows us their concern to cease environment degradation. All the consumers are expecting an increase in the brands and campaigns in favour of green marketing practices and thus protecting the environment. In the survey, majority of consumers revealed their preference of green products over normal commodities. Hence it can be concluded that over the years the consumer's concern have grown to a large extent towards the protection of the environment.

Table 1. Source of information

(N=101)

Sources	Percentage	Number of customers
Internet	60.4	61
Media	13.9	14
Family	9.9	10
Television and ads	8.9	9
Friends and others	5.9	7
Total	101	101

Table 2. Consumer perceptions about green products

Green marketing practices	Mean	Standard deviation
To manufacture products which are eco-friendly	4.32	1.105
To educate the consumers regarding the use of environmental friendly products.	4.46	1.261
To manufacture the products in an eco-friendly manner.	4.62	1.008
Using eco-friendly modes of communication for the promotion of products	4.66	0.851
Green marketing practices in association with branding the product	4.20	1.38

Consumer's Attitude

The Green Consumer Scale reliability analysis has given the value of Cronbach's Alpha as 0.758 for 5 green value statements listed in Table 3. This shows that 75.8 percent of the variance in the items is reliable variance. This also shows the internal consistency or reliability of the construct of the statements.

The consumers have grown all the more concerned about the protection of the environment and want to undertake green marketing practices which can be seen from the analysis of green value statements in Table 3. The perusal of Table 3 shows the averages and dispersion of green value statements from the point of view of the consumers. All the statements have a mean score more than 3 which show an agreement towards the fact that the consumers are concerned about undertaking green behaviours and they attach value towards it.

Multiple Regression Analysis

The perusal of Table 4 shows the impact of awareness, green practices and green values on purchase behaviour. In the output given in Table 4, it shows that the predictor values of Green practices and Green values are significant at 1 and 15 percent level of significance respectively. However, the p-value of awareness indicates that it is statistically insignificant. The model explains 93 percent of the total variation in purchase behaviour explained by three explanatory variables. The F-statistic for the overall significance of model is significant at 5 percent level.

Table 5 shows the impact of age and gender on Green

Table 3. Consumer perceptions about green value statements

Statements	Mean	Standard deviation
The products used by me as a consumer do not harm the environment	3.81	1.553
Concerned about the wastage of resources	4.48	1.188
The purchase habits are based on the concern as a consumer for the environment	3.61	1.642
Consider myself as being environmentally responsible	4.22	1.325
Use only energy efficient gadgets	3.27	1.811

values. In the output given in Table 5, we can see that the coefficient of explanatory variable age is significant statistically. However, the p-value of gender indicates that it is statistically insignificant. The model explains 16 percent of the total variation in the green values. The overall model fitting can be seen from significant F statistic. i.e. 9.799.

Association with Brands

Organic India, Fab India, Organic Food Company, are some of the brands or companies that have overtime associated themselves with green marketing practices and thus with protection of the environment. It was noticed that without any help or assistance, the consumers were unable to find or recall the names of the brands. This shows that there are some flaws in the communication strategy of these companies and there is a dire need to strengthen this area to make more and more consumers aware about green marketing.

According to the survey around 78 percent of the consumers had the willingness to buy green products if the products were a part of the necessary commodities list.

Table 6. Problems of Green Marketing Practices

(N=101)

Problems	Percentage
No knowledge	41.6
High price	17.8
Lack of shops with green products	27.7
Unreliable quality	12.9
Total	100

On a scale of 5, their mean score was found to be 3.8. Hence, it is noticed that the manufacturers need to ensure the easy availability of green products to the customers belonging to the necessity list so their purchase could be increased which in turn will benefit the society and the environment as a whole.

Majority of customers purchased green products and participated in activities undertaken for the protection of the environment and believed that there is much more scope that they can do to serve the same. The rest of the customers did not buy green products and are not involved in any initiative undertaken to protect the environment. The number of people who buy green products is quite low as compared to the increasing population of the country and thus the state of Uttar Pradesh. Hence it can be noticed that there is extreme need for better promotions of green products for the consumers.

PROBLEMS

The perusal of Table 6 reveals that the lack of knowledge about the green marketing practices is one of the major problems faced by the consumers (41.6 percent) of the total respondents. Lack of availability of green products in shops is the second most important problem faced by the consumers. 17.8 percent of the sample respondents faced high prices of the green products and 12.9 percent revealed that the unreliable quality of the green products as some of the issues in green marketing.

CONCLUSIONS

Consumers doesn't seem to be aware of various green

Table 4. Regression analysis of impact of different variables on purchase behaviour

Variables	Coefficients	Standard error	t-stat	p-value
Awareness	0.1295	0.2017	0.6423	0.5222
Green Practices	0.6774***	0.2172	3.1190	0.0024
Green Values	0.1788*	0.1146	1.5609	0.1218
R^2	0.93	F-value	471.16**	

***, ** and * Significant at 1, 5 and 15 percent level.*

Table 5. Regression analysis of impact of different variables on green values

Variables	Coefficients	Standard error	t-value	p-value
Age	0.0384***	0.0087	4.4268	0.0000
Gender	-0.0271	0.2067	-0.1313	0.8958
R^2	0.16	F-value	9.799*	

*** and * Significant at 1, and 10 percent level.*

initiatives that the state and the central governments besides other non-government bodies have undertaken and therefore they go unnoticed many of the times. Hence much more needs to be done to spread awareness amongst consumers on this account. Newspapers remain the leading source of information. Other forms of media, such as the internet and television still fail to reach of many consumers for one reason or the other.

While consumers are aware and understand the need for adopting green products and practices they are concerned about high prices and availability of green products. In order that green marketing products and practices to flourish, it is very important that green products are available to the consumers easily and at affordable prices in addition to spreading awareness about such products & practices.

The study thus provides a good focus on the consumer's behaviour regarding green products and their perceptions. The changing priorities of consumers towards green products and assessment of their green values is what the future studies should focus on. With the start of an era of green marketing, this study has a good focus on how the governments, the manufacturers, and the consumers need to change their perceptions and behaviour in order to protect the environment for a better future and to make the venture of green marketing successful.

REFERENCES

Globescan. (2014). Greendex 2014: Consumer choice and the environment. *National Geographic. Retrieved fromhttps://images.nationalgeographic.com/wpf/media-content/file/NGS_2014_Greendex_Highlights_FINAL-cb1411689730.pdf*

Haws, K. L., Winterich, K. P., & Naylor, R. W. (2010). Green consumer values. *Handbook of Marketing Scales (3rd ed.),*172-173.

Howe, J., Bratkovich, S., Bowyer, J., Fernholz, K., & Stai, S. (2010). *Green marketing-growing sales in growing markets.* Damascus: Dovetail Partners INC.

Jain, S.K., & Kaur, G. (2004). Green marketing: An attitudinal and behavioural analysis of Indian consumers. *Global Business Review,* 5(2), 187-205. *Retrieved from*https://doi.org/10.1177/097215090400500203

Polonsky, M.J. (1994). An introduction to green marketing. *Electronic Green Journal, UCLA Library, UC Los Angeles, 1(2).Retrieved from*http://escholarship.org/uc/item/49n325b7

Priya, P. (2015). Impact of agriculture on green marketing Green marketing- A reality to a few some and a strategy to many others. *International Journal of Business Management,* 2(1), 715-722. *Retrieved from* www.ijbm.co.in

Renfro, L.A. (2010). Green business operations, and green marketing. *Gatton Student Research Publication, 2*(2), 1-8.

Tiwari, J. (2014). Green marketing in India: An overview. *IOSR Journal of Business and Management, 1*(6), 33-40. Retrieved from www.iosrjournals.org

Welling, M.N., & Chavan, A.S. (2010) Analyzing the feasibility of green marketing in small and medium scale manufacturers. *Asia Pacific Journal of Research in Business Management, 1*(2),119-113.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 198-204
DOI: 10.5958/2322-0430.2018.00058.6

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Regional Market Integration and Sustainable Development: The Nexus and Policy Implications

R. Sendhil[1], Shweta Bijla[2], Darshnaben Mahida[2], Jagruti Das[2], Manjisha Sinha[2] Arghyadeep Das[2] and T. Kumareswaran[2]*

[1]*ICAR-Indian Institute of Wheat and Barley Research, Karnal - 132001*
[2]*ICAR-National Dairy Research Institute, Karnal - 132001*

**Corresponding author's email: r.sendhil@icar.gov.in*

Received: December 31, 2017 *Manuscript Number: NS-18-85* *Revision Accepted: February 15, 2018*

ABSTRACT

Commodity prices provide signal to producers, consumers and market players for decision making. Under poor market integration, price signals gets distorted leading to inefficient use of resources and inequitable welfare distribution hampering sustainable development. The paper investigates the extent of price integration and transmission in Indian wheat markets sourcing monthly wholesale prices data from July 2002 to June 2017. Spatial market integration has been tracked following Johansen's co-integration testing procedure to identify the presence of linear deterministic trend in prices, and Granger causality test has been employed to discover the direction of price transmission. The maximum likelihood test indicated that wheat markets are integrated and prices are being transmitted but not perfectly with some market pairs showing unidirectional-causality, while the rest exhibiting either bidirectional-causality or no-causality. The analysis on behavior of prices and extent of price transmission indicates that wheat markets are more competitive in a majority of regions and less competitive in the rest. Wheat markets that perform poor warrants for policy interventions and investment plans at all levels for sustainable development since the commodity is linked with livelihood and nutritional security of millions.

Keywords
Co-integration, Granger causality test, market integration, sustainable development, wheat.

JEL Codes
C22, C23, M31, Q13, Q18.

INTRODUCTION

Commodity prices play a major role in regulating production, consumption, and trade in market-driven economies resulting in sustainable development. In economic parlance, the price of agricultural commodities is determined by the interaction of demand and supply which is largely influenced by the production and consumption, stocks available with the nation coupled with government policies on procurement and distribution. The available information always gets reflected in the day-to-day market operations. India being a developing nation, wherein commodity markets embedded with several impediments like lack of infrastructure, inadequate transport facilities, weak distribution system and poor information dissemination requires the intervention of government for efficient functioning especially for primary or staple agricultural commodities. Efficient markets transmit price signals if integrated, helping in rational allocation of resources (Ahmad, 2003).

Literally, market integration refers to co-movement in prices for attaining equilibrium in the long-run and is one of the popular indicators of efficient functioning of markets. Under poor market integration, price signals gets distorted leading to inefficient allocation of resources and inequitable welfare distribution of stakeholders hampering sustainable development. Correction of market imperfections is one of the approaches followed to attain price integration, thereby facilitating for equal income distribution and sustainable market development.

Under perfect integrated markets scenario, government can stabilize the prices only in the key/dominant market expecting a similar outcome in the other volatile markets which reduces the total budget including the resource damage (Mukim *et al.*, 2009; Sharma & Burark, 2016; Mushtaq *et al*., 2008). The same principle would apply for any targeted cost-intensive intervention in markets for improving the efficiency.

India is the second largest producer of wheat in the world with 98.38Mt (million tonnes)of output produced during 2016-17 from an area of 30.60Mha. It is also the second largest consumer of wheat after China, with a huge demand hovering around 93Mt (2016-17) and expected to reach 105.49Mt by 2024-25 (USDA, 2017). The level of consumption is largely influenced by the quantum of production from rural areas followed by the price differentials between urban and rural regions (Ramdas *et al*., 2012; Nasurudeen *et al.*, 2006).Wheat is a major staple food commodity and distortion in prices representing the risk impacts the decision making process for producers, consumers and market players (Horo *et al.,* 2016; Sendhil *et al*., 2014). Probing the reasons for price differences in spatially separated markets and testing integration as well as price transmission will help to intervene with appropriate policies for better performance. The present study is an attempt to discern the behavior of prices and find the extent of integration in regional wheat markets for drawing policies aimed at sustainable market development.

DATA AND METHODOLOGY

Monthly average wholesale prices for wheat spanning from July 2002 to June 2017 (agricultural year) for 15 selected states in India (Table 1) were collected from the AGMARKNET website. Apart from conventional tools, Johansen's co-integration approach and Granger causality test were used to analyze the data. The following analytical methods were employed to address the set objectives:

Seasonal Variation in Prices: The seasonal variation in prices was calculated using the twelve months ratio to moving average method. For measuring the extent of variation in seasonal indices, the coefficient of average seasonal price variation (ASPV), intra year price rise (IPR) and coefficient of variation (CV) have been used.

$$ASPV \quad \frac{\frac{HSPI \quad LSPI}{HSPI \quad LSPI}}{2} \quad 100$$

$$IPR \quad \frac{HSPI \quad LSPI}{LSPI} \quad 100$$

$$CV \quad \frac{}{\bar{X}} \quad 100$$

where LSPI is the lowest seasonal price index, HSPI is the highest seasonal price index, σ is the standard deviation of the price series, and X is the mean of the price series.

Compound Annual Growth Rate (CAGR): The compound annual growth rate in wheat prices was calculated using the following formula (Gujarati, 2013):

$$Y_t \quad Y_0(1 \quad r)^t$$

Where Y_t is the price at time 't', Y0 is the initial price and r is the compound annual growth rate. The above equation was transformed to logarithmic function and then estimated using the Ordinary Least Square (OLS) method.

Market Integration: Co-integration test measures the long-run integration between two or more price series. A lot of improvements have been made in the methodology over time and of them, Johansen's technique has been proved to be the bestowing to its computational ease. In his approach, the test and estimation of number of co-integration relationships can be carried out simultaneously. Prior testing for co-integration, Augmented Dickey-Fuller test (ADF) has been used to test the unit root in time series for examining its stationarity (Dickey & Fuller, 1981). Later, price integration in spatially separated markets was tested using Johansen (1988) maximum likelihood methodology. The functional form is:

$$Y_t \quad {}_{i\ 1}^{k\ 1} \quad {}_i \quad Y_{t\ 1} \quad Y_{t\ k} \quad {}_t$$

Where Y_t is the price of the commodity at time t, ΔY_{t-1} is the first difference operator of the time series (Y_t - Y_{t-1}) and matrix 'is (n x n) with rank r, which represents the number of linear independent co-integration relations in the vectors of matrix. The rank of can be determined as:

$$_{trace} \quad T \quad {}_{i\ r\ 1}^{n} \ln(1 \quad {}_1), r \quad 0,1,2,..., n \quad 1$$

where, λ_i's are the Eigen values that represent the strength of the correlation between the first difference and the error-correction portion, and T is the number of usable observations. The hypotheses tested were, H_0 (null hypothesis): rank of = r and H_a (alternate hypothesis): rank of > r, where 'r' is the number of co-integration equations.

Granger Causality Test: It is done to measure the price transmission component between the markets. The test helps to find the direction of the equilibrium relationships *i.e.,* whether market p_1 Granger causes market p_2 or vice versa. Prices get transmitted between markets as a result of their perfect integration along with the development in information and communication technologies. Further, the speed of transmission and price convergence depends on the market regulations and policy reforms (Sendhil *et al.* ,2013).

$$p_{it} \quad c \quad {}_{j\ 1}^{n}(p_{1t} \quad j \quad {}_j p_{2\ t\ j}) \quad e_t$$

The null hypothesis in this case ($H_{0:1} = {}_2 = \ldots {}_n = 0$) ,was tested for the joint significance of ${}_n$ for the causal relationship among selected markets.

Law of One Price (LOOP): The law of one price has been tested by following the approach as outlined in Gandhi & Koshy (2006), Awokuse & Bernard (2007) and Sendhil *et al. (*2013a, 2014a) to identify whether wheat has the same price in geographically separated markets except for the differences incurred due to the transfer costs in different markets. In the case of two markets, under Johansen's approach, the rank of $\pi = \alpha\beta'$ will be equal to 1, and, α and β matrices will be of order 2 x 1. The LOOP for the two markets can be tested by imposing the restriction $\beta' = (1, -1)'$, and this test can be considered as a valid check for LOOP in the long-run and it can be generalised for 'n' number of markets by imposing the required restriction (Sendhil *et al*., 2013a, 2014a).

RESULTS AND DISCUSSION

Price Dynamics: Tracking the behavior of prices across spatially separated markets helps to draw policy initiatives for sustainable development through effective marketing. Wheat production being seasonal, the prices exhibited spatial and temporal variations. Summary statistics (Table 1)unequivocally showed that the growth estimated as CAGR for prices in nominal terms have been rising since July 2002 irrespective of the regional markets and it is highest in Punjab and Uttarakhand at the rate of 0.63percent per month.

A clear-cut difference in wholesale prices was noticed across regional markets for various descriptive statistics (Table 1). The maximum and average wholesale prices were highest in southern states *viz.,* Kerala (₹29.8/kg and ₹19.7/kg, respectively) and Karnataka (₹26.7/kg and ₹15.3/kg, respectively) indicating the growing consumer demand for wheat-based products but lack in production. The selected price series were positively skewed ranging from 0.1 to 0.5 except in case of Maharashtra (-0.1), Kerala (-0.2) and Odisha (-0.4) indicating that the distribution tail is slightly longer on right side than left. One of the characteristic features of price time series is non-stationary with leptokurtic distribution (Sendhil *et al*., 2014). Surprisingly, in all the markets the estimates of kurtosis was found to be negative specifying the platykurtic distribution (relatively flatter than a normal distribution but with a wide peak). Further, the skewness and kurtosis estimates present the spread of monthly prices around its mean in respective markets. The highest standard deviation in wholesale prices was found in Kerala (5.2), followed by Karnataka (4.5) and Jharkhand (4.1) while the coefficient of variation in prices was found to be highest in the case of Punjab (33.6 percent), followed by Haryana (33.5 percent) and Chhattisgarh (32 percent) and both the estimates were found to be least in the case of Odisha (3.2 and 25.1 percent, respectively). The risk in prices measured through Cuddy Della Valle index indicated that out of 15 states, less than 50 percent exhibited instability by more than 10 percent.

Seasonal Variation in Prices: Seasonal fluctuation in agricultural commodity prices require continuous monitoring for taking economic decision as they are cyclical in nature. Seasonal price variation in different wheat markets across the country has been captured through the seasonal indices of monthly prices (Fig.1). The index was highest (in December, 111.34) and lowest (in July: 90.49) for Haryana wholesale market. Due to scarcity in wheat supply prior to harvest, the seasonal indices across markets were highest during the months of January to March. Post-crop harvest with increased

Table 1. Summary statistics for monthly wholesale prices in wheat

(N=180, AY 2002-03 to 2016-17)

Particulars	Chhattisgarh	Gujarat	Haryana	Jharkhand	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Delhi	Odisha	Punjab	Rajasthan	Uttar Pradesh	Uttarakhand	West Bengal
CAGR (percent)	0.58	0.53	0.62	0.58	0.57	0.45	0.55	0.53	0.58	0.44	0.63	0.59	0.57	0.63	0.57
Maximum (₹/kg)	22.0	21.6	21.4	21.2	26.7	29.8	19.3	22.2	20.8	19.6	23.4	19.3	18.6	21.3	19.7
Minimum (₹/kg)	5.5	7.7	5.4	7.1	7.0	8.3	6.6	7.5	6.7	6.2	4.5	6.3	5.8	5.2	5.9
Range (₹/kg)	16.5	13.9	16.0	14.1	19.7	21.5	12.7	14.7	14.1	13.4	18.9	13.0	12.8	16.1	13.8
Standard Deviation	3.6	3.8	3.8	4.1	4.5	5.2	3.4	3.9	3.7	3.2	3.7	3.5	3.3	3.6	3.5
Skewness	0.5	0.3	0.2	0.1	0.2	-0.2	0.1	-0.1	0.2	-0.4	0.3	0.1	0.2	0.2	0.3
Kurtosis	-0.5	-1.2	-0.8	-1.1	-0.6	-0.9	-1.1	-1.2	-1.0	-0.8	-0.7	-1.2	-1.0	-0.7	-1.0
Average (₹/kg)	11.1	13.1	11.4	13.7	15.3	19.7	11.9	14.1	12.2	12.7	11.2	11.6	11.3	11.2	11.5
Coefficient of variation (Percent)	32.0	29.0	33.5	29.7	29.3	26.5	28.7	27.6	30.1	25.1	33.6	30.2	29.4	31.9	30.2
Cuddy della valle index (Percent)	12.7	10.5	15.7	6.5	8.5	16.3	8.5	9.1	7.5	13.8	12.9	8.3	8.0	7.7	9.5

market arrivals the indices started to fall corroborating the research findings of Mahalle *et al.* (2015). Seasonal price index variation, in general, was highest in Haryana followed by Punjab (Figure 1). The indices were highest either in January or February for all the markets barring Haryana, Kerala, Delhi, and Uttrakhand. Similarly, the lowest index was found to occur during July month for a majority of the wholesale markets which shall be attributed to the high market arrivals after crop harvest and subsequent release of public stocks.

The estimated growth (CAGR) in seasonal indices was positive for all the states except for Maharashtra. The growth rate was low across markets and found to be less than one percent (Table 2). The variation in seasonal indices exhibited a wide range from as low as 2.33 percent in Kerala to as high as 7.15 percent in Haryana. The intra-year price rise (IPR) and average seasonal price variation (ASPV) were found to be highest in Haryana wholesale market, followed by Punjab and lowest in Jharkhand wholesale market (Table 2). The IPR ranged from 9.22 percent to 23.04 percent, while the ASPV ranged from 8.81 percent to 20.66 percent. Overall, the analysis provide sufficient information to take business decisions specifically selling, stocking or buying by the different actors along the value chain *viz*., producers, traders, and consumers to ensure functioning of the market system (Mahalle *et al*., 2015).

Market Integration: Augmented Dickey-Fuller (ADF) test was done to check the stationarity and order of integration of the price series. The test results indicated the presence of non-stationarity in level and unit root in their first difference (Table 3). The test also confirmed that the order of integration of all price series to be one. After verification that each level series is I(1), Johansen's test was applied to check for price co-integration in the market system.

Table 2. Growth and variation in seasonal price index

(Percent)

Market	CAGR	IPR	ASPV	CV
Chhattisgarh	0.28	13.49	12.64	3.73
Gujarat	0.44	11.74	11.09	3.24
Haryana	0.13	23.04	20.66	7.15
Jharkhand	0.54	9.22	8.81	2.97
Karnataka	0.60	9.99	9.51	2.69
Kerala	0.19	9.41	8.99	2.33
Madhya Pradesh	0.49	9.71	9.26	2.91
Maharashtra	-0.04	12.75	11.98	3.45
Delhi	0.95	13.82	12.92	4.43
Odisha	0.71	13.57	12.71	3.96
Punjab	0.51	19.37	17.66	5.82
Rajasthan	0.37	10.04	9.56	3.30
Uttar Pradesh	0.45	12.80	12.03	4.05
Uttarakhand	0.79	15.56	14.44	4.47
West Bengal	0.32	17.15	15.80	4.92

Johansen's test is sensitive to the lag length of price series that influence integration between two or more markets. So the optimal lag length was determined using the Schwarz information criterion (SIC) and the results were furnished in Table 4. Subsequently, Johansen's test was carried out to know the extent of market integration among the selected wheat wholesale markets. The key point in running the test was to find whether the selected wheat markets are integrated in the long-run and thereby price transmission holds true which is an indicator of efficient functioning of the markets facilitating for overall development.

The perusal of Table 4 indicated that the null

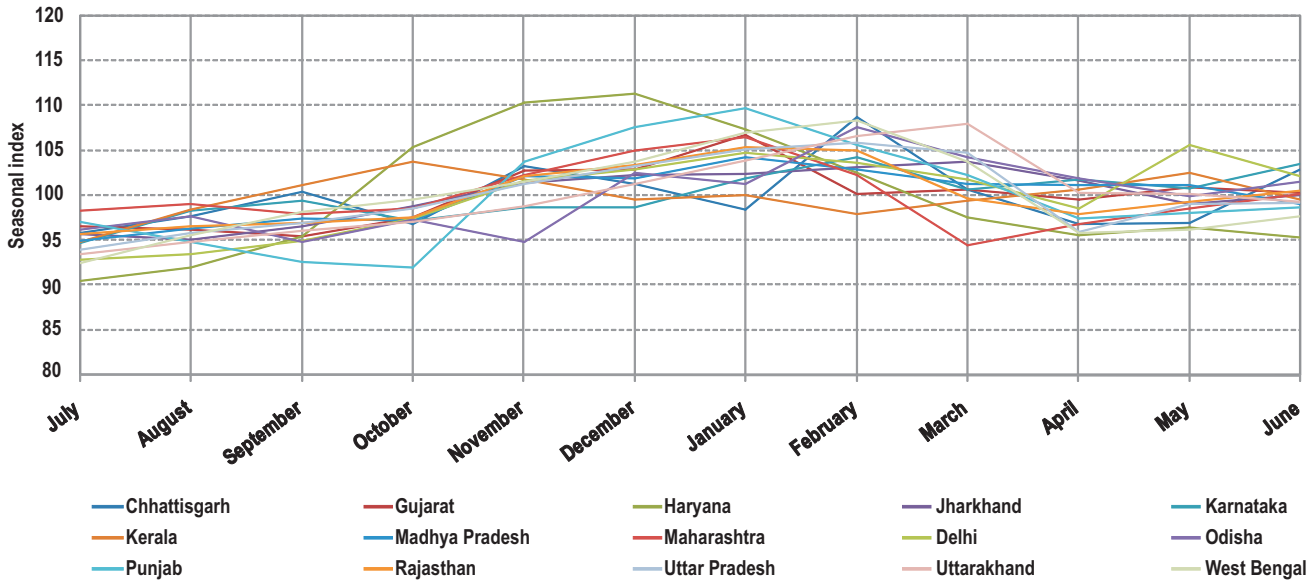


Figure. 1. Seasonal indices of monthly wholesale prices in wheat (AY 2002-03 to 2016-17)

hypothesis of no co-integration (r = 0) between the wholesale prices of selected markets was rejected at one percent level probability. The hypothesis rejection confirms the presence of one or more co-integration vectors among the regional wheat markets (Acharya *et al*., 2012; Mahalle *et al*., 2015). The trace statistic revealed the presence of six co-integrated vectors in the market system against the expected 15. Overall, the analysis pointed that the wheat wholesale markets are integrated in the long-run but not perfect providing a huge scope of policy intervention.

Table 3. Estimates of Augmented Dickey-Fuller (ADF) test

Market	ADF statistic for testing unit root		Order
	Level series	1st differenced series	
Chhattisgarh	-0.92	-15.69*	I(1)
Gujarat	-1.09	-15.79*	I(1)
Haryana	-1.42	-9.41*	I(1)
Jharkhand	-1.28	-15.50*	I(1)
Karnataka	-0.75	-17.95*	I(1)
Kerala	-2.93	-19.59*	I(1)
Madhya Pradesh	-1.08	-13.28*	I(1)
Maharashtra	-1.37	-11.06*	I(1)
Delhi	-1.42	-14.95*	I(1)
Odisha	-2.15	-20.18*	I(1)
Punjab	-1.88	-11.81*	I(1)
Rajasthan	-1.19	-11.53*	I(1)
Uttar Pradesh	-1.34	-14.59*	I(1)
Uttarakhand	-1.58	-18.29*	I(1)
West Bengal	-1.77	-10.82*	I(1)

**** indicates the significance at one percent level of MacKinnon (1996) one-sided p-values.***

Price Transmission: Post checking for market integration, the direction of price transmission was found through Granger causality test. The analysis indicated a bi-directional influence of prices in Haryana wholesale market on all other markets except for Gujarat and Maharashtra (Table 5). Jharkhand also showed a bi-directional influence on all the other markets barring Kerala (uni-directional), Odisha (uni-directional) and Rajasthan (no causality). Odisha, a state with limited wheat production and poor market infrastructure facilities exhibited price transmission only with Chhattisgarh, Haryana, Kerala, and Punjab. Interestingly, wheat wholesale prices from Rajasthan showed a bi-directional transmission to Gujarat, Haryana, and Maharashtra whereas, uni-directional transmission to rest of the selected regional markets. The transmission of prices between integrated markets leads to price adjustment from the demand and supply information available between them (Mahalle *et al*., 2015).

Law of One Price (LOOP): The relationship between all the selected wheat wholesale markets showed the presence of atleast six co-integrated vectors. Hence, the number of stochastic trends was found to be atleast nine, having 15 markets in total. The analysis indicated the absence of LOOP in all these regions confirming the existence of market distortion leading to different prices for a single commodity. On the other hand, LOOP is a reflection of perfect market integration (Zahid *et al.*, 2007). Any random change in price originated at one market when not gets reflected in other markets, it shows the absence of perfect market integration which warrants for local government interventions along the value chain to enhance the competitiveness (ESCAP, 2015).

Table 4. Estimates of Johansen's multivariate co-integration analysis

Markets	Lag length	H_0: rank= r	Eigenvalue	Trace statistic	Max Eigen statistic
Chhattisgarh	1	r = 0^	0.47	696.91	112.25
Gujarat	(-39.08)	r ≤1^	0.41	584.66	94.75
Haryana		r ≤2^	0.38	489.91	85.83
Jharkhand		r ≤3^	0.37	404.08	81.45
Karnataka		r ≤4^	0.31	322.63	65.31
Kerala		r ≤5^	0.30	257.32	63.68
Madhya Pradesh		r ≤6	0.24	193.64	49.30
Maharashtra		r ≤7	0.16	144.33	31.05
Delhi		r ≤8	0.15	113.28	28.36
Odisha		r ≤9	0.13	84.92	25.32
Punjab		r ≤10	0.11	59.60	20.69
Rajasthan		r ≤11	0.07	38.91	13.21
Uttar Pradesh		r ≤12	0.07	25.70	12.49
Uttarakhand		r ≤13	0.06	13.21	11.70
West Bengal		r ≤14	0.01	1.51	1.51

^ denotes rejection of null hypothesis at one percent level of MacKinnon-Haug-Michelis(1999) probability.

Table 5. Price transmission between markets by Granger causality test

Price transmission (Row to Column)	Chhattisgarh	Gujarat	Haryana	Jharkhand	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Delhi	Odisha	Punjab	Rajasthan	Uttar Pradesh	Uttarakhand	West Bengal
Chhattisgarh		X	↔	↔	↔	↔	X	X	X	↔	↔	X	X	↔	↔
Gujarat	→		→	↔	→	→	↔	↔	↔	→	→	↔	↔	↔	↔
Haryana	↔	X		↔	↔	↔	↔	X	↔	↔	↔	↔	↔	↔	↔
Jharkhand	↔	↔	↔		↔	→	↔	↔	↔	→	↔	X	↔	↔	↔
Karnataka	↔	X	↔	↔		→	X	↔	↔	→	↔	X	↔	↔	↔
Kerala	↔	X	↔	X	X		X	↔	↔	↔	↔	X	X	X	X
Madhya Pradesh	→	↔	↔	↔	→	→		↔	↔	→	→	X	↔	↔	↔
Maharashtra	→	↔	→	↔	↔	↔	↔		↔	→	→	↔	↔	↔	→
Delhi	→	↔	↔	↔	↔	↔	↔	↔		→	→	X	↔	↔	↔
Odisha	↔	X	↔	X	X	↔	X	X	X		↔	X	X	X	X
Punjab	↔	X	↔	↔	↔	↔	X	X	X	↔		X	↔	↔	X
Rajasthan	→	↔	↔	→	→	→	→	↔	→	→	→		→	→	→
Uttar Pradesh	→	↔	↔	↔	↔	→	↔	↔	↔	→	↔	X		→	↔
Uttarakhand	↔	↔	↔	↔	↔	→	↔	↔	↔	→	↔	X	X		X
West Bengal	↔	↔	↔	↔	↔	→	↔	X	↔	→	→	X	↔	→	

↔: Bi-directional, →: Uni-directional, and X: No Causality.

CONCLUSIONS AND POLICY IMPLICATIONS FOR SUSTAINABLE MARKET DEVELOPMENT

Horizontal market integration and price transmission reveals the extent of spatial price relationship between prices of the same product in different regions. The present study relied on wholesale prices of selected regional wheat markets for understanding the degree of spatial market integration and price transmission which guides policymakers to suggest options aiming for sustainable market development. The results of the price transmission analysis indicate that wheat markets are integrated but not perfect indicating the imperfections influenced by the quantum of trade and flow of information. Markets with poor price transmission between them serve as an indicator of inefficient performance as there is no transmission of price shocks from one market to other. In order to achieve the goal of market integration, the government should intervene on correcting the market imperfections as well as to invest on information and communication technologies to the targeted markets. The study calls for a pragmatic approach on rational allocation of resources based on the extent of price integration and transmission. Local governments having a stronghold in regional markets should take the responsibility of promoting sustainable business practices along wheat value chains like strengthening the market system in the context of sustainability; increasing the social investment; enabling the commodity trade including regulation of market fee, license for market players etc.; providing technical training for stakeholders for better price discovery; and, adopting the validated sustainability tools and instruments in the targeted market(s) in consultation with stakeholders for promoting the sustainability in overall market system.

REFERENCES

Acharya, S.S., Chand, R.,Birthal, P. S., Kumar, S., & Negi, D.S. (2012). *Market integration and price transmission in India: A case of rice and wheat with special reference to the world food crisis of 200708* (pp. 1-67). Rome: Food and Agriculture Organization.

Ahmad, M. (2003). *Agricultural product markets in Pakistan. Islamabad*: Pakistan Institute of Development Economics.

Awokuse, T.O., & Bernard, J.C. (2007). Spatial price dynamics in U.S. regional broiler markets. *Journal of Agricultural and Applied Economics, 39*(3), 447–456.

Dickey, D., & Fuller, W.A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, *49*(4), 1057-1072. doi:10.2307/1912517

ESCAP, Economic and Social Commission for Asia and the Pacific (2015). Global value chains, regional integration and sustainable development: Linkages and policy implications. *United Nations Economic and Social Council*, 71st Session, Bangkok, 25-29 May 2015.

Gandhi, V.P., & Koshy, A. (2006). *Wheat marketing and its efficiency in India*. Working Paper No.: 2006-09-03. Ahmedabad: Indian Institute of Management.

Gujarati, D.N. (2013). *Basic econometrics* (4th Ed.). New Delhi, India: Tata McGraw-Hill Edition.

Horo, A., Sendhil, R., & Das, J. (2016).Integration and price transmission in wheat markets of Uttar Pradesh, India. *Indian Journal of Agricultural Marketing, 30*(3), 168-178.

Johansen, S. (1988) Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, *12*(2): 231-254.

Mahalle, S.L, Shastri, S., & Kumar, S. (2015). Integration of wheat markets in Maharashtra. *Agricultural Economics Research Review, 28* (1), 179-187.

Mukim, M., Singh, K., and Kanakaraj, A. (2009). Market integration, transaction costs and the Indian wheat market: A systematic study. *Economic and Political Weekly, 44* (22), 149-155.

Mushtaq, K., Gafoor, A., & Dad, M. (2008). Apple market integration: Implications for sustainable agricultural development. *The Lahore Journal of Economics, 13*(1), 129-138.

Nasurudeen, P., Anil Kuruvila, Sendhil, R., & Chandrasekar, V. (2006). The dynamics and inequality of nutrient consumption in India. *Indian Journal of Agricultural Economics*, *61*(3), 362-370.

Ramdas, S., Singh, R., & Sharma, I. (2012). Exploring the performance of wheat production in India. *Journal of Wheat Research*, *4*(2), 37-44.

Sendhil, R., Babu, D., Kumar, R., & Srinivas, K. (2013a). How far do egg markets in India conform to the law of one price? *African Journal of Agricultural Research*, *8*(48), 6093-6100. DOI: 10.5897/AJAR2013.6988.

Sendhil, R, Kar, A., Mathur, V.C., & Jha, G.K. (2013). Price discovery, transmission, and volatility: Evidence from agricultural commodity futures. *Agricultural Economics Research Review, 26* (1), 41-54.

Sendhil, R., Kar, A., Mathur, V.C., & Jha, G.K. (2014). Price volatility in agricultural commodity futures-An application of GARCH model. *Journal of Indian Society of Agricultural Statistics*, *68*(3), 365-375.

Sendhil, R., Sundaramoorthy, C., Venkatesh, P., & Lijo, T. (2014a).Testing market integration and convergence to the law of one price in Indian onions. *African Journal of Agricultural Research, 9*(40), 2975-2984. DOI: 10.5897/AJAR2013.8037.

Sharma, H., & Burark, S.S. (2016). Extent of market integration of wheat in Rajasthan, *Indian Journal of Economics and Development, 12*(3), 445-452. DOI: 10.5958/2322-0430.2016.00160.8.

USDA. (2017). *International baseline data*. Retrieved from https://www.ers.usda.gov/data-products/international-baseline-data/

Zahid, M.S., Qayyum, A., & Malik, W.S. (2007). Dynamics of wheat market integration in Northern Punjab, Pakistan. *The Pakistan Development Review, 46*(4), 817-830.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 205-210
DOI: 10.5958/2322-0430.2018.00059.8

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Marketing Pattern and Price Behaviour of Rapeseed-Mustard in Punjab

Pankaj Goyal[1], Raj Kumar[2] and Rohit Saini[1]*

[1]Research Scholars and [2]Extension Specialist (Farm Management), Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141004

[*]Corresponding author's email: goyal.pankaj206@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-145* *Revision Accepted: March 09, 2018*

ABSTRACT

The present study was conducted to examine the marketed surplus, sale pattern, price spread and price behaviour of mustard in Punjab. A sample of 100 farm households was taken using multistage random sampling technique. Out of the total production of the mustard crop, quantity retained for seed was 0.93 percent, family consumption was 6.19 percent and marketed surplus was 93.02 percent. In sales pattern, the percentage of quantity handled was the highest in Channel-I (58.13 percent), followed by Channel-II (23.64 percent) and Channel-III (18.23 percent). Price spread was the lowest in Channel-III (₹ 78.07 per q) and the highest in Channel-I (₹695.52 per q). The marketing efficiency index was highest in Channel-III (45.62) which indicated that this market channel is the most efficient channel among all the channels in the study area. Significant fluctuations in terms of mustard prices were reported during the period 2011 to 2016. The mustard prices exhibit oscillatory movement along with trend line during the period 2011 to 2016.

Keywords
Marketed surplus, price behaviour, price spread.

JEL Codes
C81, Q13.

INTRODUCTION

In India, about 8 million tons of rapeseed-mustard was produced from 6.65 million ha of area during the year 2013-14. Among the major rapeseed-mustard growing states, Rajasthan has highest production in India which is 3.80 million tonnes (mt) followed by Haryana (0.88 mt), Madhya Pradesh (0.84 mt), Uttar Pradesh (0.74 mt), Gujarat (0.49 mt), West Bengal (0.48 mt), Assam (0.17 mt) and Bihar (0.11 mt). Punjab state occupied merely 0.5 percent share in total rapeseed-mustard production in India and occupied 9th position among all states in the country (Directorate of Economics and Statistics, 2015). Peak arrival period for mustard seed is between February and May. Thereafter, its arrivals start declining and least in the month of October. Delhi and Hapur are the major markets for rapeseed-mustard in India. 80 percent of the mustard oil is marketed by the unorganized sector in loose form and only 20 percent by the organized sector, mainly NODS, Jumbo, Kanodia, ITC, etc. The trade of rapeseed-mustard flow through various channels of marketing involves large number of intermediaries. The rapeseed-mustard grower's sell their produce to different agencies at different prices.

It is recognized that the increase in the physical production of rapeseed-mustard alone would not help the farmer in fully harnessing the fruits of their efforts. The farming community would be benefitted only if the net returns per unit of cultivation are fairly remunerative. For this purpose, it has to be ensured that the production of these commodities is appropriately disposed of in the market. Keeping this in view, the Government of India has been fixing the minimum support prices for these commodities year after year. But because of one reason or the other, it hasn't been possible for the government to effectively intervene in the market by way of direct purchase of these commodities from the producers. Consequently, the prices of these commodities keep on fluctuating from time to time. It is in context of such a

situation that farmers need to be assisted in obtaining the maximum share in the consumer's rupee in the market. It is particularly so because a regulated market has a large number of functionaries, who claim a substantial chunk of consumer's rupee in the form of their remuneration. These remunerations are often found to be disproportionate to the services rendered by them to the producer.

METHODOLOGY

The study was conducted in the Punjab. To draw a representative sample, multistage random sampling technique was used. At the first stage, two districts namely Fazilka and Hoshiarpur with highest area under mustard were selected. Out of these two districts four blocks (two from each district) having highest area under mustard were selected. From each selected block a cluster of two to three villages was selected randomly. From each selected cluster, 25 farm households from different farm size categories were selected randomly, thus making total sample of 100 farm households. The study was mainly based on the primary data pertaining to the agricultural year 2014-15. To study the marketed surplus and sale pattern the main marketing channels of mustard were identified on the basis of mustard sold by the producers and the intermediaries within and outside the producing area. The price spreads of mustard in the sample markets were investigated at a point of time in various marketing channels by using 'Mode method'. In order to calculate the index of marketing efficiency of a marketing channel, the costs, and marketing margins (price spread) for various marketing intermediaries was used. Marketing efficiency was calculated by using Acharya's Index of Marketing Efficiency (Acharya and Agarwal, 1999) which is stated as:

$$ME = \frac{FP}{(MC \quad MM)}$$

Where,
ME = Index of marketing efficiency
FP = Prices received by farmer
MC = Total marketing costs
MM = Net marketing margins

RESULTS AND DISCUSSION

Marketed surplus and disposal pattern of rapeseed-mustard

Marketed surplus of the produce was arrived at by deducting from farm produce the part of it used as home consumption. In short, it is the excess of receipts of total production over its consumption, and other such disposals at the farm. Marketed surplus refers to the amount of produce that is actually marketed at a particular time. The details of total production and marketed surplus of mustard crop is given in Table 1. The results revealed that the average production of mustard crop on an overall farm was estimated to the tune of 17.78 quintals, while it was 6.38, 7.94, 13.39, 26.10 and 52.64 quintals on marginal, small, semi-medium, medium and large farms respectively. Out of the total production, the share of quantity retained for family consumption came to be 6.19 percent on an overall farm, while it was the highest on marginal farms (9.87 percent) and observed to be declined with increase in farm size. The share of quantity stored for seed came out to be substantially low (0.79 percent). The quantity of marketed surplus turned out to be 16.54 quintals per farm which was 93.02 percent to the total production. It is evident that the share of marketed surplus varies with farm size.

Marketing Channels

For each commodity, a large number of buying and selling functions are to be performed for its disposal to ultimate consumers. The mustard crop follows three marketing channels through which it reaches from primary producer to ultimate consumer. The marketing channels are illustrated in Table2. The main market intermediaries were wholesaler and commission agents in the marketing mustard. The percentage of quantity handled was the highest in Channel-I (58.13 percent), followed by Channel-II (23.64percent) and Channel-III (18.23 percent), respectively.

Price Spread and Marketing Efficiency of different Marketing Channels

The study of marketing costs and margins is inevitable to improve the market structure of mustard crop. It is also helpful to improve the marketing

Table 1. Marketed surplus and disposal pattern of rapeseed-mustard in Punjab, 2014-15

(Q/farm)

Particulars	Marginal	Small	Semi-medium	Medium	Large	Overall
Production	6.38 (100.00)	7.94 (100.00)	13.39 (100.00)	26.10 (100.00)	52.64 (100.00)	17.78 (100.00)
Family consumption	0.63 (9.87)	0.61 (7.68)	1.21 (9.04)	1.48 (5.67)	1.31 (2.49)	1.10 (6.19)
Quantity kept for seed	-	-	-	0.43 (1.65)	0.25 (0.47)	0.14 (0.79)
Marketed surplus	5.75 (90.13)	7.33 (92.32)	12.18 (90.96)	24.19 (92.68)	51.08 (97.04)	16.54 (93.02)

Figures in the parentheses are percentages to their respective level of production.

efficiency by taking into account the producer's net share in the consumer's rupee and explore the further improvement in the market structure. The various marketing costs of different marketing channels is

Table 2. Different marketing channels of mustard in Punjab

Channel	Agencies/intermediaries involved	Quantity handled (Percent)
I	Producer-wholesaler (through commission agent) –processor	58.13
II	Producer-wholesaler –processor	23.64
III	Producer-processor	18.23

Table 3. Marketing costs of mustard in different marketing channels in Punjab, 2015

(₹/q)

Particulars	Channel-I		Channel-II		Channel-III	
	Marketing cost	Percent to processor's rupee	Marketing cost	Percent to processor's rupee	Marketing cost	Percent to processor' s rupee
A. Farmer						
Price received by farmer	3503.00	84.42	3525.00	85.46	3560.00	98.55
1. Transportation	22.50	0.54	19.00	0.46	-	-
2. Loading	9.74	0.23	9.50	0.23	9.15	0.25
3. Unloading	4.70	0.11	-	-	0.00	0.00
4. Cleaning	8.33	0.20	-	-	8.33	0.23
5. Imputed value of time spent	3.75	0.09	7.50	0.18	7.50	0.21
Total cost	**49.02**	**1.18**	**36.00**	**0.87**	**24.98**	**0.69**
Net price received	3453.98	83.24	3489.00	84.59	3535.02	97.86
B. Wholesaler						
Price received	4125.00	99.41	4100.00	99.40	-	-
1. Unloading	-	-	7.00	0.17	-	-
2. Cost of gunny bag	14.75	0.36	14.75	0.36	-	-
3. Weighing & filling	14.13	0.34	14.13	0.34	-	-
4. Stitching	3.30	0.08	3.30	0.08	-	-
5. Loading	4.00	0.10	3.50	0.08	-	-
6. Commission@ 2.5 percent	87.58	2.11	-	-	-	-
7. VAT @ 4.95percent	173.40	4.18	-	-	-	-
8. Transportation	-	-	-	-	-	-
Total marketing cost	**297.15**	**7.16**	**42.68**	**1.03**	**-**	**-**
Net price received	3827.85	92.25	4057.32	98.37	-	-
Marketing margin	324.85	7.83	532.32	12.91	-	-
C. Processor						
Price paid to the wholesaler/farmer	4125.00	99.41	4100.00	99.41	3560.00	98.55
1. Cost of gunny bag	-	-	-	-	14.75	0.41
2. Filling	-	-	-	-	13.25	0.37
3. Transportation	17.50	0.42	17.50	0.42	17.50	0.48
4. Unloading	7.00	0.17	7.00	0.17	7.00	0.19
Total cost	**24.50**	**0.59**	**24.50**	**0.59**	**52.50**	**1.45**
Net purchase price of processor	4149.50	100.00	4124.50	100.00	3612.50	100.00

illustrated in Table 3.

Channel-I: Producer-Wholesaler (through Commission Agent)-Processor

In this channel, the producer farmer sold the produce to wholesaler at the price of ₹3503 per quintal. During selling the produce to the wholesaler, marketing cost incurred by the farmers was ₹49 per quintal. Hence the net price received by the farmers came out ₹3454 per quintal which was about 83 percent of the processor's actual purchase price. The wholesaler further sold out the produce to the processor through commission agent at the rate of ₹4125 per quintal. The commission agent charged commission @ 2.5 percent from the wholesaler for facilitating the marketing of the produce. The total marketing cost incurred by the wholesaler worked out to be ₹297 per quintal which was about 7 percent of the processor's price. Hence net price received by the wholesaler was ₹3828 per quintal which accounted nearly 92 percent share in the processor's rupee, respectively. The marketing charges spent by ultimate processor were ₹25per quintal and hence net price received by the processor accounted for ₹4150 per quintal, respectively. This is the most important channel of marketing followed by farmers in the study area.

Channel II: Producer-Wholesaler -Processor

In this channel, the producer sold the produce directly to wholesaler at the price of ₹3525 per quintal. The total marketing cost incurred by the farmers in this channel worked out to be ₹36 per quintal and the net price received by the farmers came out ₹3489 per quintal which accounted about 85 percent of the processor's price. The wholesaler further sold out the produce to the processor at the rate of ₹4100 per quintal. The wholesaler saved commission and VAT charges by selling the produce directly to the processor in this channel. Therefore, the total marketing cost incurred by the wholesaler worked out ₹43 per quintal which was only one percent of the processor's price. Hence net price received by the wholesaler was ₹4057 per quintal which accounted nearly 98 percent share in the processor's rupee. Marketing charges spent by ultimate processor was ₹25 per quintal and hence net price received by the processor was accounted for ₹4125 per quintal.

Channel-III: Producer-Processor

Producer/farmers sold their produce directly to the ultimate processor at the rate of ₹3560 per quintal in this channel. The total marketing cost incurred by the farmers in this channel worked out to be ₹25 per quintal and the net price received bythe farmers came out ₹3535 per quintal which accounted about 98 percent of the processor's price. Hence, net price received by the farmer in this channel was the higher than other channels. The marketing charges spent by processor were₹53per quintal and hence net price received by the processor was₹3613 per quintal.

Price Spread and Marketing Efficiency of different Marketing Channels

The marketing cost observed to be varied with the number of market intermediaries. A perusal of Table 4 revealed that total marketing costs of all the market functionaries of Channel-I, II, and III worked out ₹346, ₹79 and ₹77 per quintal which occupied about 8.34, 1.91 and 2.14 percent share in the net price of the processor respectively. Marketing cost was highest in Channel-I. Wholesaler was the main functionaries in Channel-I and II and the total marketing margins of the respective channels came out to be₹325 and₹532per quintal. There

Table 4. Marketing costs, margin and producer's share in processor's rupee in various marketing channels of mustard in Punjab, April 2015

(₹/q)

Particulars	Channel-I	Channel-II	Channel-III
Marketing cost incurred by			
Farmer	49.02	36.00	24.98
Wholesaler	297.15	42.68	0.00
Processor	-	-	52.50
Total marketing cost	**346.17**	**78.68**	**77.48**
Marketing margins of			
Farmer	-	-	-
Wholesaler	324.85	532.32	-
Processor	-	-	-
Total marketing margins	**324.85**	**532.32**	**-**
Price spread	695.52	635.50	77.48
Producers net share in processor's rupee	**3453.98**	**3489.00**	**3535.02**
Price paid by processor	4149.50	4124.50	3612.50
Marketing efficiency	5.15	5.71	45.62

Figures in the parentheses are percentages to net price paid by the processor.

was no intermediary in Channel-III, therefore marketing margins was nil in this channel. Price spread was the lowest in Channel-III (₹77.48 per q) and the highest in Channel-I (₹695.52 per q). The marketing efficiency index was the highest in Channel-III (45.62 percent) which indicated that this market channel is the most efficient channel among all the channels in the study area. Same trends were observed in the previous study by Gupta & Singh (1998).

Price Behaviour of Mustard

Seasonality nature of mustard prices over the period of time is observed to be the major factor that determines the profitability of mustard growers in Punjab. In this context, it is very important to measure the price behaviour of mustard prices in the important mustard markets. Overtime monthly data on mustard prices was analysed and the results are discussed as under:

Seasonal Variation in Mustard Prices

The results pertaining to seasonal variation in mustard prices in Abohar market is given in Table 5. The monthly modal prices of mustard were used for this purpose. The results show that prices of mustard remained consistently above the annual average prices during the lean period, that is, from July to January and highest in the month of August. Lowest prices of the mustard prevailed in the month of April as the harvesting starts in this month and the prices remained relatively low from April to June.

Significant fluctuations in terms of mustard prices were reported during the period 2011 to 2016. It was lowest in 2011 and went up in the year 2012 and then remained low for two years i.e. from 2013 and 2014. Again during 2015 prices increased significantly and reached at the peak during 2016. It clearly indicated that the mustard crop contains cyclical pattern in prices. However, as the data was available for only 6 years, the periodicity of cyclical pattern is not likely to be estimated accurately. Exact cyclical nature of mustard prices could have been ascertained with help of 25 to 30 years data. The mustard prices exhibit oscillatory movement along with trend line during the period 2011 to 2016.

Variability in Arrival and prices of mustard

The extent of inter-year monthly variability with respect to arrival and prices of mustard in Abohar market is presented in Table 6. The value of coefficient of variation with respect to arrivals of mustard crop was relatively more during the months of March, August, June, September, and October (75.53 to 215.58 percent) which revealed that variability with respect to arrivals of the mustard crop was more pronounced during these months. It was the lowest in the month of April (16.72 percent), while in all other months it varied from 38.82 percent to 57.74 percent, respectively.

Monthly variability in prices of mustard showed that it was highest in August and September (19 percent). It varied between 12.45 to 17.28 percent during April to December, while it was relatively low during January to March.

Table 5. Seasonal variation in mustard prices in Abohar market of Punjab state, 2011 to 2016

Month	Seasonal indices (Percent)
April	94.82
May	97.28
June	99.50
July	100.85
August	103.84
September	102.72
October	102.34
November	101.42
December	103.21
January	100.98
February	98.58
March	96.64

Table 6. Monthly variability in the arrival and prices of mustard in Abohar market, 2011 to 2016

Month	Arrival (q)		Price (₹/q)	
	Average	CV (percent)	Average	CV (percent)
April	39115.83	16.72	3195.17	12.45
May	1805.00	54.28	3292.50	15.75
June	2758.00	131.40	3382.83	17.28
July	996.75	75.53	3114.50	14.28
August	785.50	137.87	3533.50	19.05
September	1176.67	106.97	3474.17	19.03
October	680.00	94.76	3241.25	15.77
November	286.67	53.77	3219.33	16.09
December	96.67	38.82	3401.67	12.92
January	36.50	52.31	3855.00	7.15
February	15.00	57.74	3153.33	2.19
March	3822.00	215.58	3333.20	5.25

CV: Coefficient of variation.

Table 7. Inter-year variability in arrival and prices of mustard in Abohar market, 2011 to 2016

Year	Arrival (q)		Price (₹/q)	
	Average	CV (percent)	Average	CV (percent)
2011	5281.82	237.42	2768.64	10.12
2012	5095.00	246.58	3578.92	7.47
2013	3648.60	240.49	3071.60	3.68
2014	5393.33	274.83	3227.78	5.10
2015	8629.29	179.88	3839.43	7.71
2016	7252.00	207.63	4069.40	6.46

CV: Coefficient of variation.

The information presented in Table 7 shows significant inter-year variability in arrivals and prices of mustard. During last six years, the highest variability

(274.83 percent) in arrivals of mustard crop was recorded in the year 2014, while in terms of price, it was the highest in the year 2011 (10.12 percent), respectively. The lowest intra-year variability with regard to arrivals and prices of mustard crop was recorded in the year in 2015 and 2013, respectively. Intra-year variability clearly indicated that there is need to identify and address the factors which result into such a high intra-year variability in terms of arrivals and prices.

CONCLUSIONS

The average production of mustard crop on an overall farm was estimated to the tune of 17.78 quintals, while it was 6.38, 7.94, 13.39, 26.10 and 52.64 quintals on marginal, small, semi-medium, medium and large farms, respectively. Out of the total production, the share of quantity retained for family consumption came to be 6.19 percent on an overall farm, while it was the highest on marginal farms (9.87 percent) and observed to be declined with increase in farm size, respectively. The share of quantity stored for seed came out to be substantially low (0.79 percent). The quantity of marketed surplus turned out to be 16.54 quintals per farm which was 93.02 percent to the total production. It is evident that the share of marketed surplus varies with farm size. The main market intermediaries were wholesaler and commission agents in the marketing mustard. The percentage of quantity handled was the highest in Channel-I (58.13 percent), followed by Channel-II (23.64 percent) and Channel-III (18.23 percent), respectively. Out of three marketing channels in Punjab, the most efficient channel for the sale of mustard was direct sale (Channel-III) in which the producer got the highest share.Price spread was the lowest in Channel-III (₹77.48 per q) and the highest in Channel-I (₹695.52 per q). The marketing efficiency index was the highest in Channel-III (45.62percent) which indicated that this market channel is the most efficient channel among all the channels in the study area. Prices of mustard remained consistently above the annual average prices during the lean period, that is, from July to January and highest in the month of August. Lowest prices of the mustard prevailed in the month of April as the harvesting starts in this month and the prices remained relatively low from April to June. The mustard prices exhibited oscillatory movement along with trend line during the period 2011 to 2016.

REFERENCES

Acharya, S.S., & Agarwal, N.L. (1999). *Agricultural marketing in India.* New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.

Directorate of Economics and Statistics Anonymous. (2015). *Agricultural statistics at a glance.* Government of India, Ministry of Agriculture, Department of Agriculture and Cooperation, Directorate of Economics and Statistics, New Delhi.

Gupta, S., & Singh, B. (1998). Price spread in marketing of groundnut and rapeseed-mustard in Punjab. *Indian Journal of Agricultural Marketing, 12*, 128-132.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 211-218
DOI: 10.5958/2322-0430.2018.00060.4

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Diagnostic Study of Farmers in Context of Cost and Return Analysis, Price Spread Analysis and Marketing Pattern in Mantalai Village of Udhampur District

Anil Bhat[1], Jyoti Kachroo[2], S.E.H. Rizvi[3], Manish Kumar Sharma[4], Sudhakar Dwivedi[5], S.P. Singh[6], M. Iqbal J. Bhat[7] and Rakesh Kumar[8]*

[1]Assistant Professor, [2]Professor, [3]Professor, [4]Associate Professor, [5]Associate Professor, [6]Assistant Professor, [7]Assistant Professor, [8]Research Scholar, [1, 2, 5, and 6]Division of Agricultural Economics and ABM, and [3, 4, and 7] Division of Statistics and Computer Science, [8]Research Scholar, Division of Agricultural Extension Education, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu

[*]Corresponding author's email: drbhatanil@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-93* *Revision Accepted: March 05, 2018*

ABSTRACT

The study on Diagnostic Study of Farmers in context of cost and return analysis, the price spread analysis and marketing pattern in Mantalai village of Udhampur district is conducted during the year 2015. Cereal crops do not provide much return to the farmers of the area. Moreover, vegetables are most profitable crops in the area and farmers are getting better returns from these. Farmers of the area are also trying to get returns from the growing of fruit crops. The climate of the area is also suitable for growing walnut, bei, apricot, plum, apple etc. It is the cumbersome and little bit difficult for them to market the produce to Jammu. Farmers are facing a specific problem that is road connectivity from their fields to the roadside. The fields are not well connected to the road and the link is in dilapidated conditions which force them to transport the produce through human labor which in turn increases their marketing cost resulting in a decline in their profit. They are demanding proper road connectivity from their fields to the road.

Keywords
Cost, marketing, price spreads, returns.

JEL Codes
C81, Q13, Q18.

INTRODUCTION

The Indian agriculture sector is expected to grow with better momentum in the next few years owing to increase in investment in agricultural infrastructures such as irrigation facilities, warehousing, and cold storage. Factors such as reduced transaction costs, time, better port gate management and fiscal incentives will also contribute to this upward trend. Furthermore, the increased use of genetically modified crops is also expected to better the yield of the Indian farmers. The 12th Five Year Plan's estimates of expanding the storage capacity to 35 MT and the target of achieving an overall growth of 4 percent will also go a long way in modifying the overall face of the Indian agriculture sector in the next few years.

The state of Jammu and Kashmir with its favourable climatic conditions for horticultural crops is suitable for growing many fruits and vegetables of commercial importance. Agro-climatic suitability equips the state of Jammu and Kashmir with a unique comparative edge in the cultivation of a variety of horticultural crops. Apple, pear, citrus, mango, olive, apricot, peach, grapes, ber, walnut, almond etc are the fruits mostly grown in this state. The state accounts for sixty percent production of the apple in the country and is also known as the walnut state of the country. The state has got the monopoly of trade in cherry (Bhat, 2012). The fruit industry is the second most important industry after tourism in Jammu

and Kashmir state. The fruit industry in J&K state involves about seven lakh families comprising of about 33 lakh people who are direct or indirectly associated with horticulture. The area under Fruits in J&K State has increased from 2.95 lakh hectares in 2007-08 to 3.38 lakh hectares in 2016-17.The production has increased from 16.36 lakh MTs in 2007-08 to 22.35 lakh MTs in 2016-17.The major fruits crops grown in the state are apple, citrus, mango, walnut, pear, grapes olive, ber, apricot, plum, peach, etc. (Directorate of Economics and Statistics, 2017).

The economic aspects of fruit and vegetable cultivation are not less important as well maintained and established orchards and fields give better returns than cereal crops from the same piece of land. It may also be mentioned that there are many factors which may enhance the production of fruits and vegetables but among them, cost and return coupled with marketing are considered being the key factors for increasing the production. The growers before prioritizing the preferences for establishing orchard ensures its cost and return factor, which is the main motivating factor for bringing more area vis-à-vis giving a lot of attention. Moreover, along with the production, the role of marketing opportunities are equally important, as the farmers can ensure the reasonable return for their produce and also a legitimate share in the price paid by the consumers.

Although area under fruits and vegetables and its production have shown a steady increase over time, yet their marketing aspects (comprising of marketing cost, marketing margin, marketing loss, and price spread) has all along been almost neglected and at present marketing facilities are inadequate. Under the existing marketing practice, before the produce reaches to the end user, it has to be handled and passed through a long chain of various intermediaries, with the result that the producers are getting a small share of consumers' rupee. Therefore, working out the price spread provides an opportunity to know the difference between the price received by the farmer and price paid by the consumer which comprises cost of undertaking and rendering market services such as assembling, grading, transporting, processing, wholesaling, retailing and the margins of the intermediaries, charges, sale tax, etc. as they are too wide because of its perishable nature, seasonality of production, spatial distribution of plantation far off from consuming centres, inadequate cold storage and credit facilities and lack of comprehensive marketing information. All these forces compel the growers to sell their produce unprocessed and immediately after harvest, resulting gluts in the markets and thereby fall in prices and hence lower returns.

Further, evaluating the economics of production and marketing of various crops will help the farmers of Udhampur district to a greater extent to make their cultivation and marketing more profitable besides will also act as a guideline for the planning of policy planners/ scientists. Keeping in view the importance of fruits and vegetables and the facts described above, a research study entitled, Diagnostic Study of Farmers in context of cost and return analysis, price spread analysis and marketing pattern in Mantalai village of Udhampur district, has been undertaken with the objectives as (1) to study the cost and returns of major crops and (2) to study marketing channels, cost and price spread.

METHODOLOGY

Collection of Data

The primary data from farmers was collected by survey method, using well-designed schedule. Collection of date was done by the personal interview method. The schedule was pre-tested before using for actual data collection. In addition to this collection of information regarding marketing was done by visiting farmers, various markets and contacting the different intermediaries involved in the marketing process. Also to study the various services provided and charges of varied market functionaries, commission agent/ forwarding agent, wholesalers and retailers were selected randomly and the required information, as well as data, was obtained from them. Secondary data was collected from various published sources such as bulletins of the Ministry of Horticulture, Govt. of India, Directorate of Economics and Statistics, Govt. of India, Directorate of Economics and Statistics, Govt. of Jammu and Kashmir state and Directorate of Horticulture Planning and Marketing, Government of Jammu and Kashmir state.

Cost and Returns

To achieve the stipulated objectives, the required information was collected on farm implements, machinery, farm inputs and crop yields etc. so that to work out cost and returns as well as marketing behaviour. To work out the cost various cost concepts of CACP were used.

Analysis of Marketing

The data collected were tabulated and analyzed for examining the marketing cost, margins, price spread and the marketing efficiency.

Marketing Margins, Costs, and Loss

The post-harvest loss at various stages of marketing was included either in the farmer's net margin or market intermediary's margin. In the present study, the marketing loss at different stages was explicitly estimated. The modified formulae were used for separating the 'post-harvest loss during marketing' at different stages of marketing as well as for estimating the producers' share, marketing margins, and marketing loss.

Net Farmer's Price

The net price received by the grower will be estimated as the difference in gross price received and the sum of marketing costs and value loss during harvesting, grading, transit and marketing (Acharya & Aggarwal, 2001). Thus, the net farmer's price is expressed mathematically as follows:

$$NP_F = \{GP_F\} - \{C_F\} - \{L_F \times GP_F\} \ldots \textbf{(1)}$$

Where NP_F is net price received by the farmers (₹/kg),

GP_F is gross price received by the farmers or wholesale price to farmers (₹/kg),

C_F is the cost incurred by the farmers during marketing (₹/kg),

L_F is the physical loss in produce from harvest till it reaches assembly market (per Kg or percent).

Marketing Margins

The margins of market intermediaries included profit and returns, which accrued to them for storage, the interest on capital and establishment after adjusting for the marketing loss due to handling. The general expression for estimating the margin for intermediaries is given below.

Intermediaries Margin = Gross price – Price paid – Cost of marketing – Loss in value during wholesaling

Net marketing margin of the wholesaler is given mathematically by

$MM_w = GP_w - GP_F - C_w - (L_w \times GP_w)$ or

$MM_w = \{GP_w - GP_F\} - \{C_w\} - \{L_w \times GP_w\}$ …. (2)

Where MM_w is the net margin of the wholesaler (₹/kg),

GP_w is wholesaler's gross price to retailers or purchase price of the retailer (₹/kg)

C_w is the cost incurred by the wholesalers during marketing (₹/kg),

L_w is the physical loss in the produce at the wholesale level (per kg)

In the marketing chain, when more than one wholesaler is involved, that is, primary wholesaler, secondary wholesaler, etc. then the total margin of the wholesaler is the sum of the margins of all wholesalers. Mathematically,

$MM_w = MM_{w1} + \ldots\ldots + MM_{wi} + \ldots\ldots + MM_{wn}$

Where MM_{wi} is the marketing margin of the ith wholesaler.

Net marketing margin of retailer is given by:

$MM_R = GP_R - GP_W - C_R - (L_R \times GP_R)$ or

$MM_R = \{GP_R - GP_W\} - \{C_R\} - \{L_R \times GP_R\}$ …. (3)

Where MM_R is net margin of the retailer (₹/kg),

GP_R is price at the retail market or purchase price of the consumers (₹/kg)

L_R is physical loss in the produce at the retail level (per kg),

C_R is the cost incurred by the retailers during marketing (₹/kg).

The first bracketed term in equations (1), (2) and (3) indicates the gross return, while the second and third bracketed terms indicate respectively the cost and loss at different stages of marketing.

Thus, the total marketing margin of the market intermediaries (MM) is calculated as

$MM = MM_W + MM_R$

Similarly, the total marketing cost (MC) incurred by the producer/ seller and by various intermediaries is calculated as

$MC = C_F + C_W + C_R$

Total loss in the value of produce due to injury/ damage caused during handling of produce from the point of harvest till it reaches the consumers is estimated as

$ML = \{L_F \times GP_F\} + \{L_W \times GP_W\} + \{L_R \times GP_R\}$

RESULTS AND DISCUSSIONS

The cost and return analysis of cereal crop and vegetables in Mantalai village of Chenani block are presented in Table 1. Per hectare Cost A which included all the variable costs excluding the family human labour were found to be highest (₹55416.38) for the cultivation of garlic followed by tomato (₹54260.75) whereas radish incurred lowest of ₹29361.33. The Cost B which included the fixed costs, in addition, to Cost A were ₹39020.89 for maize, ₹59074.66 for tomato, ₹37280.11 for cucumber, ₹33361.33 for radish, ₹41053.97 for beans and ₹59416.38 for garlic. The Cost C, total item wise per acre operational costs which also included the imputed value of family labour were found to be highest (₹149074.66/ha) in tomato and lowest of ₹39361.33/ha in radish. The Cost C increases in case of tomato to such an extent only because of the addition of family labour. Cost C* was also calculated by adding 10 percent of Cost C as management cost to total cost.

The Table further revealed that among per hectare working costs, the highest expenditure of ₹13444.44 and ₹90000.00 was incurred on family labour in case of maize and tomato, respectively whereas in case of cucumber and radish, it was ₹10000.00 each for land preparation. As far as beans and garlic are concerned, it was found that highest cost was incurred on purchase of seed (₹15578.95/ha) and hired labour (₹18000.00/ha), respectively. Only maize was the crop by-product also. The yield in quintals for tomato, cucumber, radish, beans, and garlic was found to be 186.35, 127.83, 100.00, 62.11 and 40.00, respectively. In the case of maize, it was 46.20 quintals per hectare with by-product of 23.70 quintals per hectare. The further perusal of data indicated that respective gross returns were ₹65494.81, ₹372705.88, ₹80347.83, ₹50000.00, ₹117044.53, and ₹120000.00, respectively for maize, tomato, cucumber, radish, beans, and garlic. Per hectare, net returns were found to be highest (₹208723.75) in tomato whereas lowest (₹6702.54) was observed in case of radish.

The per acre operational costs consists of yearly expenses on the maintenance of bearing fruit orchards. The item wise and concept wise operational costs for fruit orchards of Mantalai are presented in Table 2. The total number of walnut, apple, look, khubani, aloobukhara and aadu plants grown in the study area by the sample orchardists were found to be 148, 87, 58, 105, 25 and 35, respectively. Cost A which included all the variable costs excluding the family human labour were ₹13947.02 for walnut plants, ₹9664.25 for apple plants, ₹6992.18 for

amlook plants, ₹8702.03 for apricot plants, ₹2767.27 for plum plants and ₹3469.37 for peach plants. The Cost B which included the fixed costs in addition to Cost A were ₹17647.02 for walnut plants, ₹10464.25 for apple plants, ₹9312.18 for amlook plants, ₹10702.03 for apricot plants, ₹3221.27 for plum plants and ₹4105.37 for peach plants. The Cost C, total item wise per acre operational costs which also included the imputed value of family labour were ₹24247.02 for walnut plants, ₹14964.25 for apple plants, ₹12312.18 for amlook plants, ₹11902.03 for apricot plants, ₹3821.27 for plum plants and ₹5605.37 for peach plants. Cost C* was also calculated by adding 10 percent of Cost C as management cost to total cost.

The Table further revealed that among the working costs, the highest expenditure of ₹6600.00, ₹4500.00, ₹3000 and ₹1500.00 was incurred on family labour in case of walnut, apple, amlook and peach, respectively whereas in case of apricot and plum, it was found to be ₹2625 and ₹625.00, respectively on land preparation. The yield for all walnut, apple, amlook, apricot, plum, and peach plants was found to be 8, 33, 12, 8, 3, and 7 quintals respectively. The further perusal of data indicated that respective gross returns were ₹114285.71, ₹34155.00, ₹22500.00, ₹20000.00, ₹4500.00 and ₹14000.00, respectively for all walnut, apple, amlook, apricot, plum and peach plants. Net returns were found to be highest (₹87613.99) in walnut plants whereas lowest (₹296.60) was observed in case of plum.

Marketing Pattern and Price Spread Analysis

Market structure of the study area for cereal, vegetables and fruit crops

It was imperative to study the activities of each agency taking part in trade in the study area. The agencies that facilitated the flow of different crops till they reached the ultimate consumer were producers themselves, commission/ forwarding agents, wholesalers, and retailers. The chain of various intermediaries/ functionaries commonly known as marketing channel comprising of agencies like producers, commission/ forwarding agent, wholesalers, and retailers etc. and also sometimes, direct sale of produce help in distribution of fruits/ crops from producers to ultimate consumers in study area. The marketing channels identified for maize,

Table 1. Cost and return analysis of cereal crop and vegetables in Mantalai village of Udhampur block

(₹/ha)

Items		Cereal	Vegetables				
		Maize	Tomato	Cucumber	Raddish	Beans	Garlic
Land preparation		6629.63	10000.00	10000.00	10000.00	10000.00	14000.00
Seed		2241.67	8000.00	5860.87	8000.00	15578.95	12000.00
Manure		19398.15	20000.00	6666.67	6666.67	6666.67	6666.67
Urea		429.81	880.00	880.00	880.00	880.00	550.00
DAP		1440.00	2400.00	2400.00	2400.00	2400.00	2400.00
Hired Labour		3383.33	12000.00	6000.00	0.00	0.00	18000.00
Depreciation		980.75	980.75	980.75	980.75	980.75	980.75
Total		34503.34	54260.75	32788.29	28927.42	36506.37	54597.42
Interest on working capital @ 6 percent p.a. for 3 months		517.55	813.91	491.82	433.91	547.60	818.96
Cost A		35020.89	55074.66	33280.11	29361.33	37053.97	55416.38
Rental Value of Owned Land		4000.00	4000.00	4000.00	4000.00	4000.00	4000.00
Cost B		39020.89	59074.66	37280.11	33361.33	41053.97	59416.38
Family Labour		13444.44	90000.00	6000.00	6000.00	6000.00	0.00
Cost C		52465.33	149074.66	43280.11	39361.33	47053.97	59416.38
Cost C*		57711.86	163982.13	47608.13	43297.46	51759.36	65358.02
Yield (q)	Product	46.20	186.35	127.83	100.00	62.11	40.00
	By product	23.70	0.00	0.00	0.00	0.00	0.00
Rate per quintal (₹)	Product	1200.00	19764.71	628.57	500.00	1884.62	3000.00
	By-product	424.00	0.00	0.00	0.00	0.00	0.00
The total value of output (₹)	Product	55444.44	372705.88	80347.83	50000.00	117044.53	120000.00
	By product	10050.37	0.00	0.00	0.00	0.00	0.00
Gross returns (₹)		65494.81	372705.88	80347.83	50000.00	117044.53	120000.00
Net returns (₹)		7782.95	208723.75	32739.70	6702.54	65285.17	54641.98

vegetables, and fruits are as under:

Maize Crop

Channel-I:Producer Local Retailer Consumer

Vegetables

Channel-I: Producer Forwarding/ Commission Agent (Narwal) Retailer (Jammu) to Consumer

Channel-II: Producer Local Retailer Forwarding/ Commission Agent (Narwal) Retailer (Jammu) to Consumer

Fruits

Channel-I: Producer Local retailer to Kanak Mandi (Jammu) Retailer (Jammu) Consumer

Channel-II: Producer Narwal Mandi (Jammu) Retailer (Jammu) Consumer

Channel-IIA: Producer Kanak Mandi Retailer to Jammu

Channel-III: Producer to consumer

Marketing Analysis for Cereals and Vegetables

The channel wise decomposition of marketing costs and price spread components for maize and vegetables in Mantalai village are presented in Table 3. The table revealed that the major items of producer's expenses in all the channels included cost of bags, transportation cost, and loading/unloading charges, etc. In Channel-I and II, commission of the forwarding/ commission agent was also added to the marketing cost in addition to other costs. Marketing costs incurred by producer varies from ₹30.00 per quintal in garlic to ₹590.00 per quintal in tomato. The marketing cost at retailer's level varies from ₹80.00 per quintal radish in to ₹255.00 in garlic. The post-harvest loss was also calculated and highest loss of ₹63.00 per quintal were found in tomato whereas lowest of ₹5.00 per quintal were observed in radish. There was no post-harvest loss in case of maize and garlic. As far as marketing margin is concerned, it was found to be highest (₹1945.00/q) in the case of garlic. Producer's share in consumers' rupee in case of maize was found to be 96.00 percent whereas in vegetables it ranges from 50.00 percent in radish and garlic to 57.14 percent in tomato.

The channel wise decomposition of marketing costs and price spread components for fruits in Mantalai village are presented in Table 4. The major items which played important role in marketing cost in almost all the fruits included picking, filling, cost of container, transportation

Table 2. Cost and return analysis of fruit crops in Mantalai village of Udhampur block

(₹/ha)

Items	**Fruits**					
	Walnut	**Apple**	**Amlook**	**Apricot Khubani**	**Plum Aloo Bukhara**	**Peach Aadu**
Plants	148.00	87.00	58.00	105.00	25.00	35.00
Land preparation	3700.00	2175.0	1450.0	2625.00	625.00	875.00
Manure	3700.00	2175.0	1450.0	2625.00	625.00	875.00
DAP	1184.00	696.00	464.00	840.00	200.00	280.00
Herbicides	1218.82	716.47	477.65	864.71	205.88	288.24
Hired Labour	2700.00	2700.0	2100.0	600.00	300.00	300.00
Depreciation	654.75	654.75	654.75	654.75	654.75	654.75
Total	13157.5	9117.2	6596.4	8209.46	2610.63	3272.9
Interest on working capital @6percent p.a.	789.45	547.03	395.78	492.57	156.64	196.38
Cost A	13947.0	9664.2	6992.1	8702.03	2767.27	3469.3
Rental Value of Owned Land	3700.00	800.00	2320.0	2000.00	454.00	636.00
Cost B	17647.0	10464.	9312.1	10702.03	3221.27	4105.3
Family Labour	6600.00	4500.0	3000.0	1200.00	600.00	1500.0
Cost C	24247.0	14964.	12312.	11902.03	3821.27	5605.3
Cost C*	26671.7	16460.	13543.	13092.23	4203.40	6165.9
Yield (q)	8.00	33.00	12.00	8.00	3.00	7.00
Rate per quintal (₹)	14285.7	1035.0	1875.0	2500.00	1500.00	2000.0
Total value of output (₹)	114285.	34155.	22500.	20000.00	4500.00	14000.
Net returns	87613.9	17694.	8956.6	6907.77	296.60	7834.0

cost, loading and unloading charges and traders' commission. These costs varied to the extent of ₹833.33 per quintal for Channel-III in peach to ₹2510.00 per quintal for Channel-II in walnut. The cost of walnut was high because of ₹1200.00 per quintal cost incurred on picking and filling. Seven percent commission of the forwarding/commission agent was also added to the marketing cost incurred by producer in addition to other costs. The marketing costs at retailer's level vary from ₹225.00 per quintal for Channel-I in apple to₹870.00 for both the channels in walnut. In case of apricot, plum, and peach on Channel-III was visible i.e. direct marketing to consumers. Retailers were also supposed to pay 5 percent commission to the forwarding/commission agents. The post-harvest loss was found to the tune of ₹18.00 per quintal in case of apples only. As far as marketing margin of retailer is concerned, it was found to be highest (₹9130.00/q) in the case of walnut. Producer's share in consumers' rupee ranges from 23.44 percent in amlook to 60.00 percent in walnut. In case of apricot, peach, and plum, it was found to be 100 percent because of direct sale to consumers. The results are in close conformity with Lepeha *et al.* (1993).

CONCLUSIONS AND RECOMMENDATIONS

The research has identified that cereal crops are concerned; it does not provide much return to the farmers of the area. Moreover, vegetables are most profitable crops in the area and farmers are getting better returns from these. Cultivation of vegetables is increasing their standard of

Table 3. Marketing Pattern and Price Spread analysis of cereal and vegetable crops in Mantalai village of Chenani block

(₹/q)

Particulars	Producer to local retailer to consumer	Channel-I				Channel-II
		Tomato	Cucumber	Raddish	Beans	
	Maize					Garlic
Producer's sale price	1200.00	2000.00	628.57	500.00	1884.62	3000.00
Producer's expenses						
Cost of gunny bags/ petti	10.00	250.00	125.00	100.00	100.00	10.00
Loading/unloading	0.00	100.00	100.00	133.32	80.00	0.00
Transport	25.00	100.00	100.00	133.32	80.00	20.00
Commission @7percent	0.00	140.00	44.00	35.00	131.92	0.00
Total costs	35.00	590.00	369.00	401.64	391.92	30.00
Net sale price	1165.00	1410.00	259.57	98.36	1492.70	2970.00
Local Retailer's level						
Purchase price	0.00	0.00	0.00	0.00	0.00	3000.00
Local Retailer's Sale Price	0.00	0.00	0.00	0.00	0.00	3800.00
Transport	0.00	0.00	0.00	0.00	0.00	100.00
Loading/unloading	0.00	0.00	0.00	0.00	0.00	100.00
Commission@ 7percent to F/C agent	0.00	0.00	0.00	0.00	0.00	266.00
Total cost	0.00	0.00	0.00	0.00	0.00	466.00
The net sale price of local retailer	0.00	0.00	0.00	0.00	0.00	3334.00
Retailer's level						
Purchase price	1200.00	2000.00	628.57	500.00	1884.62	3800.00
Commission@ 5percent to F/C Agent	0.00	100.00	31.43	25.00	94.23	190.00
Transport	0.00	20.00	20.00	20.00	20.00	20.00
Loading/unloading	0.00	15.00	15.00	15.00	15.00	15.00
Rehri/ Shop rent	0.00	20.00	20.00	20.00	20.00	20.00
Total costs	0.00	165.00	86.43	80.00	149.23	255.00
Spoilage due to physical injury and	0.00	63.00	6.29	5.00	18.85	0.00
Marketing Margin	50.00	1272.00	478.71	415.00	1447.30	1945.00
Consumer price	1250.00	3500.00	1200.00	1000.00	3500.00	6000.00
Producers' share in consumers' rupee (percent)	96.00	57.14	52.38	50.00	53.85	50.00

Table 4. Marketing Pattern and Price Spread analysis of fruits in Mantalai village of Chenani block

(₹/q)

Particulars	Walnut		Apple	Amlook	Apricot	Plum	Peach
	Channel		Channel	Channel	Channel	Channel	Channel
	I	II	I	IIA	III	III	III
Producer's sale price	12000.00	15000.0	1035.00	1875.00	2500.00	1500.00	2000.00
Producer's expenses							
Cost of gunny bags/ petti	60.00	60.00	120.00	30.00	250.00	250.00	250.00
Picking/ filling	0.00	1200.00	0.00	0.00	400.00	400.00	400.00
Loading/unloading	0.00	50.00	50.00	50.00	50.00	50.00	50.00
Transport	100.00	150.00	50.00	150.00	133.33	133.33	133.33
Commission @7percent	0.00	1050.00	0.00	131.25	0.00	0.00	0.00
Total costs	160.00	2510.00	220.00	361.25	833.33	833.33	833.33
Net sale price	**11840.00**	**12490.0**	**815.00**	**1513.75**	**1666.67**	**666.67**	**1166.67**
Local Retailer's level							
Purchase price	12000.00	0.00	1035.00	0.00	0.00	0.00	0.00
Local Retailer's Sale Price	15000.00	0.00	1800.00	0.00	0.00	0.00	0.00
Transport	150.00	0.00	300.00	0.00	0.00	0.00	0.00
Picking/ filling	1200.00	0.00	0.00	0.00	0.00	0.00	0.00
Loading/unloading	50.00	0.00	50.00	0.00	0.00	0.00	0.00
Commission@ 7percent to F/C agent	1050.00	0.00	126.00	0.00	0.00	0.00	0.00
Total cost	2450.00	0.00	476.00	0.00	0.00	0.00	0.00
The net sale price of local retailer	12550.00	0.00	1324.00	0.00	0.00	0.00	0.00
Retailer's level							
Purchase price	15000.00	15000.0	1800.00	1875.00	0.00	0.00	0.00
Commission@ 5percent to F/C Agent	750.00	750.00	90.00	93.75	0.00	0.00	0.00
Transport	75.00	75.00	100.00	50.00	0.00	0.00	0.00
Packing/ cleaning	20.00	20.00	5.00	200.00	0.00	0.00	0.00
Loading/unloading	10.00	10.00	10.00	10.00	0.00	0.00	0.00
Rehri/ Shop rent	15.00	15.00	20.00	15.00	0.00	0.00	0.00
Total costs	870.00	870.00	225.00	368.75	0.00	0.00	0.00
Spoilage due to physical injury and rotting, etc. (PHL)	0.00	0.00	18.00	0.00	0.00	0.00	0.00
Marketing Margin	9130.00	9130.00	1957.00	5756.25	0.00	0.00	0.00
Consumer price	25000.00	25000.0	4000.00	8000.00	2500.00	1500.00	2000.00
Producers' share in consumers' rupee (percent)	48.00	60.00	25.88	23.44	100.00	100.00	100.00

living also. Farmers of the area are also trying to get returns from the growing of fruit crops. The climate of the area is also suitable for growing walnut, bei, apricot, plum, apple etc. Moreover, area is famous for the production of amlook which is having religious importance as it is used in Prashad. So, government can take initiative and promote cultivation of fruit crops in the area by providing subsidies under horticulture schemes. This will definitely help the farmers of the area to increase share of fruit crops in their income. As the people of the area are marketing their produce mostly to Jammu which is difficult for them and moreover they are not getting better price for their produce. Therefore, establishment of vegetable assembling center will definitely help them to overcome the above problem. If possible Government may take initiative of marketing their produce directly to Jammu on nominal transportation cost. Farmers were also demanding training and awareness camps regarding latest technology for improving the production and marketing of crops.

REFERENCES

Acharya, S.S., & Aggarwal, N.L. (2001). *Agricultural marketing in India* (3rd ed.). New Delhi: Oxford & IBH Publishing Company.

Bhat, A. (2012). *Economic analysis of production and*

marketing of citrus in Jammu region of J&K state (Doctoral Thesis). Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu (J&K).

Directorate of Economics and Statistics. (2017). *Economic survey of J&K*. Srinagar: Directorate of Economics and Statistics, Government of J&K.

Lepeha, Y., Ali Md. H., Maity, A., Mukherjee, A.K., & Chattopadhayay, T. K. (1993). Economics of marketing of mandarin orange in Darjeeling district of West Bengal. *Economic Affairs*, *38*(4), 232-241.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 219-222
DOI: 10.5958/2322-0430.2018.00061.6

NAAS Score: 4.82
www.naasindia.org
UGC Approved

India's Foreign Trade of Agricultural Products in Free Market Economy

Sukhpal Singh, H.S. Kingra, Shruti Bhogal and Sumit Bhardwaj*

Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141 004, India

**Corresponding author's email: sukhpalpau@yahoo.com*

Received: January 15, 2018 *Manuscript Number: NS-18-98* *Revision Accepted: March 10, 2018*

ABSTRACT

Though India has become food surplus and the advancement of technology and the free flow of capital is available, but the country faces setbacks at qualitative ends. Despite increasing value of exports, the country is still not able to achieve a surplus balance of trade. The present paper examines the trends, composition, and directions of trade of agricultural products in the liberalized economy. Among the countries of the world, India shares better trade relations with Vietnam, UAE, Saudi Arabia and the USA. In order to strive for a favorable balance of trade, there is a need to explore potential markets for agricultural products in Europe and Africa with prime focus on the integration of technological innovation and better marketing infrastructure.

Keywords
Agricultural product, export, growth, import, trade, India.

JEL Codes
O24, P45, Q17.

INTRODUCTION

Foreign trade has been a building block for the development of any country. Integration into the world economy has proven to be a powerful means to promote economic growth, sustainable development, and poverty reduction. In the developing countries like India, rapidly increasing population and squeezing natural resources, the path of growth depends upon the balance of trade of agricultural products. The business environment of the Indian economy became more proactive and the nature of the economy was remodeled with the inflow of foreign capital and development of science and technology (Harikumar, 2014). This remodeling improved all spheres of the economy. Indian agrarian economy that accounts for 54.6 percent of its workforce and was largely subsistence in nature, as it has about 59 percent of its population dependent on it, also became export-oriented after being food surplus.

The technological advancement has facilitated the country's importance globally as India ranks first in rice and third in wheat export in the world. Also, the merit listing of the Indian economy in case of other agricultural products is endless like that for vegetable, fruits, rubber, tea, coffee, etc. (Renjini & Kaur, 2016). Keeping in view the above scenario, the present paper was undertaken to study the trends and direction of export and import of agri-products in the era of liberalization.

METHODOLOGY

The present study was based on the sources secondary data for balance of trade from various government organization for the period from 1991-92 to 2015-16. Keeping in view the objectives of the study,conventional tools and techniques like simple average, percentages, Compound Annual Growth Rate were used.

RESULTS AND DISCUSSION

Trends and Composition of Foreign Trade

The Indian imports have shown an increase over a period as it increased from ₹1206 crore in 1990-91 to ₹43731 crores in 2015-16at constant prices of 1993-94 (Table 1).This increase was about 36 times in 2015-16 relative to 1990-91. However, the percentage of agricultural imports to total imports witnessed fluctuation from time to time. Overall, this percentage increased from 2.79 percent in 1990-91 to 5.63 percent in 2015-16. The trends of India's agricultural exports have a different story to tell. Though the value of total agricultural exports increased from ₹6013 crores in 1990-91 to ₹67144 crores

in 2015-16 at constant prices of 1993-94, the share of agricultural exports to total exports followed a fluctuating trend but witnessed an overall decline as its share declined from 18.49 percent in 1990-91 to 12.55 percent in 2015-16 (Table1). The position on the balance of trade exhibits an unfavorable balance of trade, the gap of which is increasing over time.

The compound annual growth rate (CAGR) of agricultural imports exhibits a significant increase (Table 2). Similarly, the CAGR of agricultural export was 12.22 percent during the period 1990-91 to 1999-00,which declined to 8.47 percent during the period of 2000-01 to 2009-10. The overall CAGR of import and export was 11.78 and 8.99 percent, respectively.

The crop-wise growth rate of agricultural imports in the liberalized Indian economy reveals that the growth rate of import of wheat at constant prices increased by 19.58 percent for the period 1991-92 to 1999-00, it was 84.07 percent for the period 2001-02 to 2009-10 (Table 3). However, there was a negative growth rate of 3.54 percent of wheat import for the overall period 1991-92 to 2015-16. The growth rate of import of rice was negative for the time periods 1991-92 to 1999-00, 2001-02 to 2009-10 and the overall period of 1991-92 to 2015-16 as it was 37.50 percent, 22.91 percent and 8.03 respectively.

The growth rate of processed agricultural imports in liberalized economy exhibits a negative growth of cereal products (21.45 percent) at constant prices for the period 1991-92 to 1999-00 (Table 4). This growth rate became positive for the period of 1991-92 to 2015-16.

Table 5 depicts that the crop-wise growth rate of agricultural exports at constant prices for the periods of 19991-92 to 1999-2000 and 2001-02 to 2009-10 for wheat underwent a negative growth rate of 39.76 percent and 69.48 percent respectively, while other crops like non-basmati rice, other cereals, pulses, cotton and fresh vegetables underwent a negative growth rate at various periods of time. However, during the overall period of the study, all these crops exhibited a positive growth rate.

As seen from Table 6, India also has some importance in the market of processed agricultural products as the growth rates of various processed products like guar gum,

Table 2. CAGR of India's agricultural imports, exports, and balance of trade(1993-94=100)

Year	Agricultural imports	Agricultural export	Balance of trade
1990-91 to 1999-2000	26.22**	12.22**	4.43
2000-01 to 2009-10	6.17**	8.47**	9.45
2010-11 to 2015-16	16.19**	8.48	0.21
Overall	11.78***	8.99**	7.44***

******, **, and * Significant at 1, 5, and 10 percent level.***

Table 3. CAGR of agri-imports in liberalized economy (1993-94=100)

Item	1991-92 To 1999-00	2001-02 to 2009-10	2011-12 to 2015-16	Overall
Wheat	19.58	84.07	109.88	-3.54
Rice	-37.50	-22.91	43.23	-8.03
Oilseeds	-8.39	50.92	19.65	11.54
Other Cereals	60.98	33.13	31.1	27.88
Cotton	13.88	-8.24	29.06	15.60
Jute	12.78	-0.58	-12.94	16.42

Table 4. CAGR of processed agri-imports in liberalized economy (1993-94=100)

Item	1991-92 to 1999-00	2001-02 to 2009-10	2011-12 to 2015-16	Overall
Cereal Products	-21.45	7.08	16.22	1.68
Sugar	151.89	29.23	24.22	22.22
Veg. Oil	48.82	5.90	14.96	16.66
Cashew	25.39	10.95	15.60	30.79
Spices	25.39	10.11	22.1	28.72
Pulses	2.02	19.22	20.01	13.05

Table 1. Trends in India's agricultural imports and exports since 1990-91 (1993-94=100)

(₹Crore)

Year	Agricultural Imports	percent of agricultural imports to total national imports	Agricultural export	percent of agricultural export to total national exports	Balance of trade
1990-91	1206	2.79	6013	18.49	-4807
1995-96	4844	4.80	16774	19.18	-11931
2000-01	7763	5.29	18406	14.23	-10643
2005-06	8166	2.42	23361	10.02	-15195
2010-11	19026	3.03	42113	9.94	-23086
2015-16	43731	5.63	67144	12.55	-23413

Table 5. CAGR of agri-exports in liberalized economy (1993-94=100)

Item	1991-92 to 1999-00	2001-01 to 2009-10	2011-12 to 2015-16	Overall
Wheat	-39.76	-69.48	75.35	10.25
Basmati rice	8.09	14.41	13.03	11.09
Non-Basmati rRice	34.53	-5.09	90.08	7.82
Other cereals	13.54	55.27	-14.29	30.46
Pulses	25.70	-1.91	7.76	10.41
Cotton (raw)	-10.28	18.92	-8.80	7.51
Fresh vegetables	-1.79	15.77	12.61	34.00
Fresh fruits	3.38	17.04	8.61	33.13
Sesamum	12.29	10.67	5.75	10.92
Groundnut	48.41	19.49	3.51	16.65
Tobacco unmanufactured	7.01	14.49	4.72	6.9
Floricultural items	25.86	8.43	5.61	9.07

Table 6. CAGR of processed agri-export in liberalized economy (1993-94=100)

Item	1991-92 to 1999-00	2001-01 to 2009-10	2011-12 to 2015-16	Overall
Tobacco	5.14	5.22	14.14	8.53
Tea	1.70	0.30	1.35	0.90
Coffee	15.67	4.09	4.76	3.40
Spices	15.65	13.25	7.85	10.31
Cashew	6.66	-0.69	7.40	1.83
Guar gum	26.10	10.82	-8.52	14.05
Castor oil	19.78	7.85	2.76	7.92
Shellac	2.53	-2.83	2.50	3.17
Marine products	8.35	-28.21	19.02	-4.61
Processed veg.	8.56	11.52	12.96	29.07

spices, tobacco, castor oil, coffee, etc. exhibit a positive growth during the period of 1991-92 to 2015-16. However, only marine products exhibited a negative growth rate of exports for the overall period of study of 1991-92 to 2015-16.

Direction of Foreign Trade

It is very important to study the direction of import and export of any country. India has had good trade relations with the countries of the world, especially for agricultural products (Table 7). Of the total exports of agricultural products from India, the maximum share of exports was towards Vietnam followed by the United Arab Emirates, Saudi- Arabia, and United States during 2016-17.

Policy Issues

Despite various efforts and policy measures to promote trade and improve the overall economic health of

Table 7. Top 10 destination of India's export in the phase of liberalization

(US $ million)

Country	1996-97	Percent share in total export	2006-07	Percent share in total export	2016-17	Percent share in total export
Vietnam	11.3	0.5	40.5	0.9	2248.5	13.9
United Arab Emirates	211.2	9.8	404.0	8.6	1387.4	8.6
Saudi Arabia	286.3	13.2	468.4	10.0	1148.7	7.1
United States	191.5	8.9	295.0	6.3	914.2	5.6
Nepal	7.6	0.3	84.4	1.8	657.1	4.1
Iran	46.2	2.1	47.4	1.0	646.5	4.0
Iraq	1.8	0.1	7.5	0.2	636.2	3.9
Malaysia	112.4	5.2	216.3	4.6	622.8	3.8
Indonesia	62.3	2.9	129.3	2.8	518.7	3.2
Bangladesh	84.2	3.9	330.8	7.0	395.4	2.4
Other Countries	1146.9	53.1	2669.4	56.8	7015.7	43.4
World	**2161.7**	**100.0**	**4693.0**	**100.0**	**16191.2**	**100.0**

Source: Government of India, (2016-17).

the country, India is still bound by the shackles of various characteristics of a typical developing economy. The increasing rate of growth is still not able to render a surplus balance of trade. In the context of the existing status of the Indian economy, there is a need to emphasize a shift from imports to exports, especially processed products. Indian trade should also be explored in European and African countries. There is a need to integrate the technological innovation and better marketing infrastructure so as to encourage the processing industry which can boost the lagging exports and help strike a favorable balance of trade.

REFERENCES

Government of India. (2016-17). *Annual reports*. Directorate General of Commercial Intelligence and Statistics (DGCIS), Ministry of Commerce and Industry, New Delhi.

Harikumar, M.A. (2014). Changing phases of India's international trade before and after liberalization period. *International Journal of Application or Innovation in Engineering and Management, 3*(3), 72-76.

Renjini V.R., & Kaur, A. (2016). Composition, intensity, and competitiveness of agricultural trade between India and ASEAN. *Indian Journal of Economics and Development, 12*(2), 249-254.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 223-226
DOI: 10.5958/2322-0430.2018.00062.8

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Production and Marketing Challenges of Strawberry Cultivation in Haryana

Shiv Prakash[1#], Debashis Sarkar[2], Dalip Kumar Bishnoi[3] and Ram Singh[4]*

[1]*Ph.D. Scholar, and* [2]*Associate Professor,Department of Agricultural Economics, Vishva-Bharti, Shantiniketan-731235 (WB)*
[3]*Assistant Scientist, Department of Agricultural Economics, CCSHAU, Hisar-125004, and* [4]*Professor*
College of Post-Graduate Studies, Central Agricultural University, Umroi Road, Umiam-793 103 (Meghalaya)

[*]*Corresponding author's email: dalipbishnoi@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-105* *Revision Accepted: February 23, 2018*

ABSTRACT

The results of the study revealed that 98 percent of the grower stated that the runner's propagation was not possible in their fields due inability to reproduce the runners. About 97 percent of growers have reported higher establishment cost at the initial stage of strawberry cultivation is the major financial constraints for resource-poor farmers. 96 percent strawberry growers stated lower success rate of runners. The high cost of runners was reported by 95 percent of growers which limited their strawberry cultivation, as the runners not produced in Haryana State and it purchased from abroad or outside of the state namely Himachal Pradesh. Disease and pest as production problems were faced by the ninety-three percent strawberry growers. More than ninety percent respondents reported that labour scarcity is the major problem because strawberry is highly labour intensive crop. Eighty-fivepercent of the strawberry growers were opined that very fragile and high sensitivity of strawberry crop towards unfavourable climatic conditions such as hails storm and other unfavourable climate condition. As far as marketing problems of strawberry was concerned, 100 percent of strawberry growers were reported lack of scientific storage facilities followed by non-availability of agro-processing units (97 percent), no provision of minimum support price (92 percent), lower of prices due to seasonal glut (81 percent), delay in payment by the wholesaler/retailer (72 percent) etc. were reported. Apart from production as well as marketing problems of strawberry growers, retailers respondents of strawberry were reported lack of scientific storage facilities followed by wastage and spoilage (95 percent), highly perishable nature of strawberry fruit (92.50 percent), Lower demand by consumers in local markets (82.50 percent), non-availability of agro-processing units (52.50 percent) was observed as the major retailers related marketing problems in the study area. Keeping in view all the constraints regarding production and marketing of strawberry growers as well as marketing problems of retailers, there is strong need to develop scientific storage, processing, value addition and efficient marketing systems so that strawberry growers, as well as retailers, can get better prices of their produce.

Keywords
M.S.P., perishable, processing, runners, storage, value addition.

JEL Codes
C81, Q02, Q12, Q13.

INTRODUCTION

Indian agriculture is diversifying into the production of high-value fruits, also providing an increasing role to small holding farmers as most of the cultivable land in the country belongs to the small category of farmer. Thus, in a holistic way, horticulture can be promoted as a means of agro-diversification for the second Green Revolution, providing the much-needed impetus to the growth of the agricultural sector, through an increase in trade, income, and employment. With the launch of National Horticulture Mission (2016) in 2005, the production of horticulture crop was found to be increased with the increase in area. The total domestic demand for fruits is expected to increase of 25.47 million tonnes by 2020. This huge demand of fruits for domestic consumption is a challenge to meet out by the country. Along with this, the

[#]***This work is being published from Masters' Research of the first author.***

goal to produce horticultural products for exports can act as an engine of growth to the agricultural sector. However, growth in the fruit production and processing sub-sectors provides employment opportunities and income generation.

Haryana, one of the 29 states of the country which has an immense scope for strawberry production as the climatic condition is highly favourable for the crop. The growers also can receive the comparatively higher profit on selling the fruit due to its high value in nature. Hence, producing strawberry is becoming an alternative source of income for the farmers of the state. But unfortunately, despite strawberry being profitable, it could spread and it might be due to unaware of the profitability of the crop. They are also not well aware of the proper marketing channel and marketing strategy to be followed for getting the due share of producers in consumer's rupee. Shortage of runners (seedling) which are not readily available in their farm has become a matter of concern in the recent past. On the contrary, the organised market for strawberry made the traders/ middlemen the major players in the marketing of strawberry. Keeping all these into consideration, the present study on strawberry cultivation is an imperative as there is no such type of study carried out in this regard.

Hence, keeping in view the importance of the crop and the various problematic situations associated with strawberry cultivation, the study has been undertaken in Haryana state.

METHODOLOGY

Hisar and Bhiwani districts have taken purposively for the study on the basis of highest area and production of strawberry under these districts. Hisar district comprises of nine blocks. Out of nine blocks, the Hisar-1 block was selected purposively for the study based on the highest area and production of strawberry. Bhiwani district comprises of twelve blocks. Out of twelve blocks, Siwani block was selected purposively for the study based on the highest area and production of strawberry. Two villages namely Sahadawa, Satrod Khurd from Hisar-1 block of Hisar district whereas Chanana and Siwani villages were selected from Siwani block of Bhiwani district for the study. Total 120 strawberry growers were interviewed randomly. To study the marketing of strawberry in the study area, Azadpur market was purposively selected because more than 80 percent of the produce is being traded only in this market. Four functionaries involved in the marketing of strawberry were selected at each stage for the study. Both primary, as well as secondary data, were used in the study. Primary data collected from the sample farmers through the personal interview with the help of pre-tested and well-structured schedule. The primary data pertains to the general information, assets, cropping pattern, details on various inputs used in strawberry cultivation viz; runner (seedling), fertilizers, manure, plant protection, labour and cultivation practices such as; land preparation, source of irrigation, drip irrigation, inter-cultural and harvesting and labour used in strawberry cultivation and problems faced by the producer during the crop year 2015-16. Data on the marketing of strawberry includes, disposal of strawberry, marketing cost incurred by various intermediaries in the marketing of strawberry, producer's share in consumer's rupee, price spread, and margins earned by the various intermediaries involved in the marketing process at different stages were collected and problems faced by the different intermediaries. The data pertains to price and cost of inputs and output were collected from the respective villages on the basis of prevailing prices. Appropriate statistical tools were applied to draw the meaningful inference from the study.

RESULTS AND DISCUSSION

Problems Faced by Strawberry Growers

The problems faced by the farming community regarding agricultural enterprises has attained a paramount significance since it acts as an important source for the policymakers for the formulation of policies for the welfare of the farming community. The selected strawberry growers were contacted through opinion survey for analyzing the problems in production as well as in the marketing of strawberry in the study area. They expressed the number of problems, which are presented in Table1. The detailed inquiry into these problems will help in exploring the opportunities for enhancing strawberry production and marketing efficiency in the study area. The problems were classified into production and marketing, among production problems 98 percent of the grower stated that the runners' propagation was not possible in their fields due inability to reproduce the runners. About 97 percent of growers have reported higher establishment cost at the initial stage of strawberry cultivation is the major financial constraints for resource-poor farmers. 96 percent strawberry growers stated lower success rate of runners. The high cost of runners was reported by 95 percent of growers which limited their strawberry cultivation, as the runners not produced in Haryana State and it purchased from abroad or outside from the state i.e. Himachal Pradesh. Disease and pest as production problems were faced by the ninety-three percent strawberry growers. More than ninety percent respondents reported that labour scarcity is the major problem because strawberry is highly labour intensive crop. Eighty-five percent of the strawberry growers were opined that very fragile and high sensitivity of strawberry crop towards unfavorable climatic conditions such as hails storm and other unfavorable climate condition. More than 60 percent of the strawberry growers reported that non-availability of proper technical know-how from Department regarding strawberry cultivation. Timely availability of runners, as well as quality water for irrigation purpose, also were observed as the major production problems in the strawberry cultivation (57 percent).Lower productivity of strawberry was also reported the production problem due to the sandy

soil texture and extremely hot as well as cold weather conditions in the study area (70 percent).

As far as marketing problems of strawberry was concerned, 100 percent of strawberry growers were reported lack of scientific storage facilities followed by non-availability of agro processing units (97percent), no provision of minimum support price (92 percent), lower of prices due to seasonal glut (81percent), delay in payment by the wholesaler/retailer (72 percent), lower demand in local markets (67 percent), predominance of commission agent in the marketing system (62 percent), high cost of packaging material (55 percent), lack of transportation facilities (42 percent) and lack of proper market information (43 percent) in the study area. Similar results were observed by Kambara & Shelley (2002); Kharse *et al.* (1995); Singh & Shrivastava (2003).

Strawberry marketing problems related to retailers in the study area are presented in Table 2. All the surveyed retailers respondents of strawberry were reported lack of scientific storage facilities followed by wastage and spoilage (95 percent), highly perishable nature of

Table 2. Problems faced by strawberry retailers

(N=20)

Particular	Percent
Lack of storage facilities	100.00
Wastage and spoilage	95.00
Highly perishable fruit	92.50
Lower demand by consumers in local markets	82.50
Non-availability of agro-processing unit	152.50
Total	**100.00**

Figures in the parentheses are the percentage of the total.

Table 1. Problems faced by strawberry grower

(N=120)

Particular	Percent
Problems faced by strawberry grower during production	
Inability to reproduce the runners in this area	98.33
High value of initial investment	97.50
High price of runners	95.00
Unfavorable climate condition	85.00
Unavailability of runners in time	57.50
Lack of water availability for irrigation	56.67
Non-availability of quality of runners	69.17
Lack of information on government subsidy	62.50
Non-availability of labour	91.67
Poor quality of land	70.83
No provision of technical support from state extension staff	40.00
High cost of production due to unsuccessful sprouting of runner	96.67
Attack of pest and diseases	93.33
Lack of knowledge of recommended practices	7.50
Lack of finance at reasonable rate of interest	54.17
Problems faced by strawberry grower during Marketing	
Lack of storage facilities	100.00
Low price due to seasonal glut	80.83
Non-availability of agro-processing unit	97.50
Lack of transportation	41.67
Non-availability of market	54.17
Delayed payment by the wholesaler/retailer	72.50
No provision of minimum support price	91.67
Predominance of commission agent in the marketing system	62.50
High cost of packaging material	55.83
Highly perishable fruit	79.17
Lack of demand in local markets	66.67
Lack of proper market information	43.33
Total	100.00

Figures in the parentheses are the percentage of the total.

strawberry fruit (92.50 percent), Lower demand by consumers in local markets (82.50 percent), non-availability of agro-processing units (52.50 percent) were observed as the major retailers related marketing problems in the study area. Similar results were reported by Rao & Singh (2009); Kerutagi *et al.* (2009); Naphade & Tingre (2008).

CONCLUSION S

The study was conducted in Hisar and Bhiwani districts on the basis of highest area and production of strawberry under these districts. The results of the study revealed that 98 percent of the grower stated that the runners propagation was not possible in their fields due inability to reproduce the runners. About 97 percent of growers have reported higher establishment cost at the initial stage of strawberry cultivation is the major financial constraints for resource-poor farmers. 96 percent strawberry growers stated lower success rate of runners. The high cost of runners was reported by 95 percent of growers which limited their strawberry cultivation, as the runners not produced in Haryana State and it purchased from abroad or outside from the state i.e. Himachal Pradesh. Disease and pest as production problems were faced by the ninety-three percent strawberry growers. More than ninety percent respondents reported that labour scarcity is the major problem because strawberry is highly labour intensive crop. Eighty-five percent of the strawberry growers were opined that very fragile and high sensitivity of strawberry crop towards unfavourable climatic conditions such as hails storm and other unfavourable climate condition etc.As far as marketing problems of strawberry was concerned, 100 percent of strawberry growers were reported lack of scientific storage facilities followed by non-availability of agro-processing units (97 percent), no provision of minimum support price (92 percent), lower of prices due to seasonal glut (81 percent), delay in payment by the wholesaler/retailer (72 percent), etc. were reported. Apart from production as well as marketing problems of strawberry growers, retailers respondents of strawberry were reported lack of scientific storage facilities followed by wastage and spoilage (95 percent), highly perishable nature of strawberry fruit (92.50 percent), Lower demand by consumers in local markets (82.50 percent), non-availability of agro-processing units (52.50 percent) were observed as the major retailers related marketing problems in the study area. Keeping in view all the constraints regarding production and marketing of strawberry growers as well as marketing problems of retailers, there is strong need to develop scientific storage, processing, value addition and efficient marketing systems so that strawberry growers, as well as retailers, can get better prices of their produce.

REFERENCES

Kambara, M.K., & Shelley, L.C. (2002). *The California agricultural direct marketing study*. U.S. Department of Agriculture. Agricultural Marketing Service. Transportation and Marketing Programs. Marketing Services Branch. California Institute of Rural Studies Davis, California.

Kerutagi, M.G., Ramchandra, V.A., Kunnal, L.B., Mahajanshetti, S.B., & Shirol, A.M. (2009). Marketing of sapota in Northern Karnataka. *Indian Journal of Agricultural Marketing, 23*(2), 57-63.

Kharse, Y.T., Lohar, N.S., Babar, V.S., & Bhosale, G.M. (1995). *Economics of production and marketing of strawberry in Kolhapur region* (pp. 245-250). AGRESCO Report. MPKV, Rahuri.

Naphade, S.A., & Tingre, A.S. (2008). Economics of production and marketing of guava in Buldhana district of Maharashtra. *Indian Journal of Agricultural Marketing, 22*(2), 33-41.

National Horticulture Mission. (2016). *Statistics annual report 2001-02 to 2015-16*. National Horticulture Board, Gurugram (Haryana).

Rao, P.P., & Singh, B.P. (2009). Marketing of agricultural produce in rainfed regions of India: Emerging scenario. *Indian Journal of Agricultural Marketing*, *23*(Conference special),125-139.

Singh, R.S., & Shrivastava, P. (2003). Production and marketing of pineapple in Meghalaya. *Indian Journal of Agricultural Marketing*, *17*(Conference special), 158-160.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 227-233
DOI: 10.5958/2322-0430.2018.00116.6

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Agricultural Land Marketing Pattern in South-western Region of Punjab

Harish Bansal[1] and M.K. Sekhon[2]*

[1]Research Scholar, and [2]Senior Economist (Marketing), Department of Economics and Sociology Punjab Agricultural University, Ludhiana-141004

[*]Email of the Corresponding Author: sekhonmk@yahoo.co.in, sekhon@pau.edu

Received: January 14, 2018 *Manuscript Number: NS-18-118* *Revision Accepted: March 08, 2018*

ABSTRACT

Land transactions regarding sale/purchase from the year 2011-2015 were noted down from patwari circle of south-western region of Punjab. A total of 120 respondents were purposively selected, out of which 106 (88.33 percent) involved in sale/purchase transactions for purpose of farming and 14 (11.77 percent) were purchased land for non-agricultural purposes. The proportion of farmers who sold land was highest among the small (26.67 percent) and semi-medium farmers (33.33 percent) and lowest among large farmers. The expenditure on debt payment, migration and social ceremonies were positively and significantly influence sale market. However, the proportion of farmers who purchased land was highest among medium farmers (39.13 percent) and lowest among marginal farmers (8.70 percent). The land was also transacted towards non-agricultural uses purchased by colonizers, property dealers, and commission agents. The factors like agricultural income and non-farm income had positively and significantly influenced land purchase market.

Keywords
Agricultural land, marketing pattern, debt payment.

JEL Codes
C31, Q13, Q15.

INTRODUCTION

The land is one of the most important assets of a farmer, providing food for the family while surplus yield can be used to earn income. A land market can be defined as the demand and supply function with relation to its price. Land ownership pattern is influenced by several factors; the important among them are an inheritance, sale policy, and land transactions. The land market transaction is also influenced by the permanent transfer through sale and temporary through a lease. Both these type of market transactions, namely sale and lease, affect patterns of ownership as well as utilization of agricultural lands. Land transferred through non-market channels like inheritance, gift, dowry etc is influenced by demographic and sociological processes of the society. The impact of such non-market land transfers on land concentrations has been little explored, on the other hand, there is a widely held belief that market transfers of farmland lead to concentrations of land in capitalistic countries (Shergill, 1986). In India, the land sale market was small as compared to the rental market. Under the restrictive land sales market in India, the transactions costs for buying land are very high. The government imposed a certain type of stamp duties which further increase the transaction cost (Awasthi, 2009) in addition cumbersome procedure of register of the land sale. The new farm technology has many implications for contractual arrangements in land and labour markets, productivity, and pattern of resource use. The extent of landlessness and inequality in land ownership has not changed much and the incidence of tenancy has declined (Vaidyanathan, 1994). In agriculturally progressive states such as Punjab and Haryana there was sizeable decline size of ownership holdings and the area owned by bigger size-groups, thus swelling up the number of small and marginal farmers (Grewal & Rangi, 1981). The small farmers rent in the

land but the practice of renting land, in general, is decreasing over time (Rai *et al.,* 1991). The marginal and small farmers had lost a major share of their holdings in the process of land transactions (Sarap, 1995). The small and marginal farmers also find it difficult to sustain on farming due to increase in agrarian crisis, are pushed out from agriculture sector (Singh *et al.,* 2009). In a developing economy, people migrate to urban areas and adopted non-farm activities are unable to cultivate their own land, all of them willing to lease-out their land (Sharma, 2006). Thus the present study was planned to investigate the pattern of sale/purchase of agricultural land and to identify the factors affecting the agricultural land market.

SAMPLE SELECTION AND ANALYTICAL TECHNIQUE

The study is empirical in nature which seeks to analyze the extent and magnitude of land sale/purchase and their consequences. The study relies on primary data collected from South-Western region of Punjab. Multistage random sampling technique was used to select the district, block, village and farm household. For the purpose of the study, two districts Faridkot and Bathinda were selected. Out of these selected districts, four blocks and six villages selected namely Deviwala and Sibiaa from Kotkapura, Dhaipai from Jaitu, Maur kalan from Maur, Gummti kalan and Selbrah from Phul block. The land transactions and names of farmers were noted down from patwari circle from the years 2011 to 2015. The respondents who had either sold or purchased land during this period were taken in the sample. In this way, the total sampled households were 120 consisting of 60 sellers, 46 purchase land for agricultural uses and 14 farmers purchase agricultural land for non-farming activities. The data required for the study were obtained from the farmers by administering pre-tested structured interview schedule and the data pertained to the agricultural year of 2015-16. Tabular and linear variable regression model was applied for analyzing the data collected.

The sale factor was calculated for the expenditure occurred in last five years and the purchase factor, that is, the income of farmers was calculated annually. Factors affecting sale and purchase of land have been worked out by using the linear regression model:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\ldots\ldots+\beta_5X_5+u$$

For the Land Sale Market

Y = Sold land (ha)

β_0=Constant term

$B_{1.....}\beta_6$ = Regression Estimates

X_1 = Expenditure on Social Ceremonies (₹)

X_2 = Loan Repayment (₹)

X_3 = Expenditure on Foreign Migration (₹)

X_4 = Expenditure on Medical Treatment (₹)

X_5 = Expenditure on house construction (₹)

u = Random Error Term

For the Land Purchase Market

Y_i = Purchased land (ha)

β_0= Constant term

$B_{1.....}\beta_5$ = Regression Estimates

X_1 = Salary income (₹/annum)

X_2 = Agricultural Income (₹/annum)

X_3=Income from abroad (₹/annum)

X_4 = Livestock income (₹/annum)

X_5= Income from rent (₹/annum)

u = Random Error Term

RESULTS AND DISCUSSION

The variation has been observed in socio-economic characters of the respondents. In the analysis of the socio-economic status of sampled farmers the aspects considered were family size, education, age and farm holding size of the families. The perusal of Table 1 shows that the cultivators in all the categories of farmers have fallen into the category of old age because the average age worked out is more than 50 years. The obvious interpretation of the result is that farming in Punjab managed by the old age farmers. As these farmers did not belong to the category of higher education. The majority of respondents fall in the group of 51-65 years. The results showed that the younger generation of Punjab shows disenchantmentin agriculture.

It was found that the medium and large farmers were more educated as compared to other farm size categories with an average schooling year of 11.34 and 11.60 respectively. But the average family size was more in case of semi-medium and medium farmers i.e. 4.97 and 5.18 members per family.

The Table also concluded that there was the decline in average size of operational holding after the land

Table 1. Socio-economic profile and operational size of respondents land after transactions

Particulars	Farm size categories					
	Marginal	Small	Semi-medium	Medium	Large	Overall
Average age	56.88	49.51	53.82	51.71	52.6	52.51
Number of years in school	7.41	8.58	8.08	11.34	11.6	9.13
Average family size	4.94	4.74	4.97	5.18	3.6	4.9
Farm size before the transaction (ha)	0.59	1.47	3.03	5.84	12.00	3.63
Farm size after the transaction (ha)	0.16	1.31	2.80	5.95	12.21	3.57

transactions. Before the transaction, the average size of operational holding was 3.63 ha and it decreases to 3.57 ha. There was a sizeable decline in the marginal, small and semi-medium categories of farmers.

In addition to age, education, size of owned land, the rental value of land and prices show imperfect demand for land. The increasing population has been exerting a continued pressure on agricultural land in a multifaceted manner, such as more land is required for increasing employment within agriculture, for increasing food demand, raw material and for housing. It was observed that land rent in the study area varied from ₹30 thousand to ₹41 thousand per acre. With the increase in the land rent profit in agriculture is squeezing over time. After all, farmers earning from these transactions, they go for leasing-in land. The average land rent in all selected villages was ₹36.35 thousand per acre. The minimum land rent was found in Selbrah (₹33.46 thousand/acre) whereas the maximum land rent prevailed in Maur kalan (₹38.25 thousand/acre). In Dhaipai, Deviwala, Sibiaa and Gummti Kalan, the land rent per acre was ₹36.33, ₹36.56, ₹37.49, and ₹37.04 thousand per acre, respectively. It was observed that the lease of agricultural lands was usually for cultivation purpose whereas the sale of agricultural land took place for both agricultural and non-agricultural uses and so are the prices of land. In addition, the land quality characteristics in terms of land rent rating and the socio-economic characteristics of buyers and sellers influence and complicate land market for both purposes.

It was observed that land prices in selected villages. The average price was ₹14.32 lakh per acre. The range of land price lies between ₹3.36 lakh to ₹40.26 lakh. The minimum and maximum price were found in Maur kalan which ranges between ₹3.36 lakh to 40.26 lakh per acre. The prices of land mainly depend upon the land productivity, competition among buyers and location of land etc.

The nature and pattern of sale/purchase affect the socio-economic conditions of rural households. The extent of sale/purchase among rural households in different districts is given in Table. The total land in sampled villages was 7422 ha. The average owned land of the sellers was 3.23 ha and the total land sold was 0.39 ha. The proportion of area sold to the owned land was 12.07 percent. The average owned land of purchasers was 4.18 ha and the average purchased land by them was 0.36 ha. The proportion of area purchased to the owned area was 8.61 percent. This concluded that the average area sold by farmers was more as compared to area purchased so the size of operational holdings decreases.

Table 4 reveals that the proportionate share of farmers involved in the land sale and purchase market. The proportion of farmers who sold land was highest among semi-medium category (33.33 percent) and lowest among

Table 2. Rental value and price of land across sampled villages

Districts	Villages	The range of land rent (₹000'per acre)	Average land rent (₹000' per acre)	Range of land price (₹lakh per acre)	Average land price (₹lakh per acre)
Faridkot	Dhaipai	30-41	36.33	5.00-28.80	11.35
	Deviwala	35-40	36.56	7.20-20.80	13.33
	Sibiaa	35-41	37.49	8.00-24.58	15.10
Bathinda	Maur kalan	35-39	38.25	3.36-40.26	20.63
	Gummti kalan	32-41	37.04	7.22-40.00	14.01
	Selbrah	30-36.5	33.46	7.23-21.33	10.47
	Average	30-41	36.35	3.36-40.26	14.32

Table 3. The extent of sale/purchase among rural households

Total transactions	Faridkot	Bathinda	Total
No. of farmers who sold land	30	30	60
Total land in sampled villages (ha)	2951	4471	7422
Average owned land of seller farmers (ha)	2.95	3.50	3.23
Average sold land (ha)	0.51	0.29	0.39
The sold area as a percentage of owned land	17.28	8.28	12.07
Number of the farmer who purchased land	22	24	46
Average owned land of buyer farmers (ha)	3.98	4.37	4.18
Average purchased land (ha)	0.50	0.24	0.36
The purchased area as a percentage of owned land	12.56	5.49	8.61

large farmers (3.33 percent). Among the farmers who sold their land, 11.67 percent marginal, 26.67 percent small and 25.00 percent medium farmers. It was observed that loan payment and expenditure on social ceremonies and immigration were the major dominant reasons for the land sale.

The small and marginal farmers not only engaged in land sale market but also they participated in land purchase market. The proportion of semi-medium (28.26 percent) and medium farmers (39.13 percent) was highest as compared to other categories in the purchase of farmland. The large farmers not engaged in either sale market or purchase market as they had diversified income. Some recent studies revealed that uneconomic land holdings, migration to the urban area, loan payment and expenditure on social ceremonies were the dominant reasons which influence the marginal farmers to sell out their land (Awasthi, 2009).

The extent of land sold in relation to farm size is depicted in Table 5. The total number of farmers who sold land was 60. The average owned land of these farmers was 3.23 ha and average land sold was 0.39 ha. Overall, the proportion of sold land percentage to owned land was 12.07 percent. The average owned land of households ranged between 0.42 ha to 12.17 ha.

The average sold land on different farms ranges between 0.02 to 0.55 ha. It was observed that the proportion of sold land to the owned area was highest among the marginal farmers 45.23 percent followed by small farmers 30.21 percent and lowest among the large farmers (0.16 percent)) respectively. It was concluded that marginal and small farmers sold the major part of their land due to debt payment, low returns from agriculture and stagnant productivity. Many studies also concluded that low returns from agriculture, rising input costs, and stagnant productivity was also observed as reasons for land sale (Bera, 2015)

The perusal of Table 6 revealed that the average owned land of these farmers who purchased land was 4.18 ha and they purchased 0.36 ha of land. The overall proportion of purchased land to owned land was 8.61 percent. The average owned land ranged between 0.42 ha to 12.17 ha.

As the Table 6 shows the proportion of purchased

Table 4. Distribution of sellers and buyers farmers across different farm size categories

Farm size categories	Number of sellers	Percentage	Number of purchasers	Percentage
Marginal (<1 ha)	7	11.67	4	8.70
Small (1-2 ha)	16	26.67	7	15.22
Semi-medium (2-4 ha)	20	33.33	13	28.26
Medium (4-10 ha)	15	25.00	18	39.13
Large (>10 ha)	2	3.33	4	8.70
Total	60	100.00	46	100.00

Table 5. The extent of sold land in relation to owned land

Farm size categories	Number of farmers	Average owned land (ha)	Average sold land (ha)	Sold land percentage to owned land
Marginal	7	0.42	0.19	45.23
Small	16	1.39	0.42	30.21
Semi-medium	20	3.00	0.55	18.33
Medium	15	5.60	0.31	5.53
Large	2	12.17	0.02	0.16
Total	60	3.23	0.39	12.07

Table 6. The extent of purchased land in relation to owned land

Farm size categories	Number of farmers	Average owned land (ha)	Average purchased land (ha)	Purchased land percentage to owned
Marginal	4	0.80	0.08	10.00
Small	7	1.24	0.15	12.09
Semi-medium	13	2.63	0.29	11.02
Medium	18	5.59	0.51	9.12
Large	4	11.44	0.54	4.72
Total	46	4.18	0.36	8.61

land percentage to owned land was highest among the small farmers (12.09 percent) followed by semi-medium farmers i.e. 11.02 percent. It was clear that the average area purchased was more among the medium 0.51 ha and large farmers 0.54 ha but the marginal and small farmers bought small plots only for house construction i.e. 0.08 ha and 0.15 ha respectively.

The farmers not only purchase land for agricultural purposes but also for the non-farming activities. Table 7 represents the buyers of land and volume of land purchased by farmers for non-agricultural purposes. Farmers together bought 24.40 ha of land. Out of which, 68.98 percent land was bought by farmers for farming activities and 31.02 percent land was transacted towards non-farming activities. From the total of 7.57 ha, 1.80 ha was bought by colonizers, 1.51 ha by property dealers, 2.96 ha by commission agents and businessmen and 1.30 ha by other persons including NRI and servicemen. The proportion among colonizers was highest 23.78 percent and lowest among the others (NRI and servicemen), 17.18 percent. The table also indicates that from the total of 60 purchasers, 46 farmers purchase land to increase their size of operational holdings and 14 farmers purchase land to increase their income from non-farm activities. This scenario shows that about 31 percent of the purchased area have been gone for non-agricultural purposes as a result the size of operational holdings declined.

It is important to find out the reasons whether farmers were selling land under distress conditions or not. Heavy debt, family consumption needs, drug addiction, family size pressure, and low returns from agriculture were the factors that affect the land sale market (Mani & Pandey 1997). The present study also shows that the dominant reason for land sale in all size groups was the repayment

Table 7. Buyers of land and volume of land purchased for non-farming uses

Categories	Number of respondents	Total purchased land (ha)	Average purchased land (ha)	Percentage of total purchased land
Land purchased for the non-agriculture purpose				
Colonizers	3	1.80	0.59	23.78
Property dealers	6	1.51	0.25	19.94
Commission agents and Businessmen	2	2.96	1.47	39.10
Others	3	1.30	0.43	17.18
Sub-total	14	7.57	0.53	31.02
Land purchased for the farming purpose				
Sub-total	46	16.83	0.36	68.98
Total	60	24.40	0.40	100.00

Table 8. Reasons for the sale of land among farming households

Particulars	Farm size categories					
	Marginal (n_1=7)	Small (n_2=16)	Semi-medium (n_3=20)	Medium (n_3=15)	Large (n_4=2)	Total (N=60)
Loan payment	5 (71.43)	9 (56.25)	13 (65.00)	7 (46.67)	0 (0.00)	34 (56.67)
Expenditure on Social ceremonies	2 (28.57)	11 (68.75)	11 (55.00)	7 (46.67)	0 (0.00)	31 (51.67)
Lower returns from agriculture	3 (42.86)	5 (31.25)	8 (40.00)	8 (53.33)	1 (50.00)	25 (41.67)
Sending children abroad	4 (57.14)	2 (12.50)	8 (34.78)	9 (60.00)	0 (0.00)	23 (38.33)
Medical treatment	2 (28.57)	5 (31.50)	12 (60.00)	4 (26.67)	1 (50.00)	24 (40.00)
Division of land	2 (28.57)	10 (62.50)	10 (50.00)	7 (46.67)	0 (0.00)	29 (48.33)
Pressure by arhtiyas	3 (42.86)	8 (50.00)	6 (30.00)	10 (66.67)	0 (0.00)	27 (45.00)
Construction of house	5 (71.43)	4 (25.00)	10 (50.00)	7 (46.67)	1 (50.00)	27 (45.00)

Figures in parentheses are percentage to the total number of farmers in the respective categories.

of old debts (56.67 percent). Expenditure on social ceremonies was another reason for land sale (51.67 percent). Agriculture not remaining the profitable business, cost of cultivation increases and squeezes the margins. So, lower returns from agriculture were also to be observed as a reason for agriculture land sale. Among the sampled farmers, the other reasons like sending children abroad, house construction and medical treatment reported by 38.33, 45.00, and 40.00 percent respectively.

It may be noted that in the study area speculative dealings or land purchased were alleviated. A few years back, farmers lured by high prices offered for land, they tend to sell to others who convert the agricultural lands into plots for higher profits including speculative gains. Also, all the sampled farmers sold their land in acres at the prevailing market price only, no case of distress sale in terms of farm market reported. Most farmers (41.67 percent) were forced to sell due to their adverse conditions. It was clear that distress sale was not in term of lower market prices but has taken place due to their adverse conditions prevailed at the time. The adverse conditions usually shape a backward bending supply relation indicating decreased supply of land for sale with the increase in its price, as the higher land price meets the distress need obligation with the lower amount of land sold.

The results presented in Table 9 exhibit the frequency distribution of land transactions among different farm size category of farmers. It was observed that 58.69 percent farmers purchase land to increase their size of operational holding. 34.78 percent farmers purchase land for further investment purposes in non-farming sectors. Some farmers utilize their livestock income and foreign remittance to purchase agricultural land but their number was low as compared to others.

The classification of land sale transaction out of total 60 for the purpose of buying revealed that while the majority of the land purchase transaction was for cultivation i.e. 58.69 percent and 34.78 percent were made for non-agriculture uses. This was also concluded the transfer of small size of parcels for housing purpose. Out of total buyers, some farmers also going for diversification to industries. This can be regarded as the

Table 10. Determinants of land sale market

Variables	Regression coefficients	p-value
Intercept	0.13	0.36
Expenditure on social ceremonies	0.16***	0.0016
Loan repayment	0.17**	0.038
Expenditure on migration	0.16***	0.000006
Expenditure on medical treatment	0.17NS	0.51
Expenditure on construction of house	0.15***	0.000001
R^2	0.65	

**** and, ** Significant at 1 and 5 percent level.*
NS: Non-significant.

Table 11. Determinants of land purchase market

Variables	Regression coefficients	p-value
Intercept	0.045	0.84
Salary income	-0.086NS	0.40
Agricultural income	0.17***	0.000045
Income from abroad	0.0027NS	0.56
Income from dairy	-0.06NS	0.87
Income from land rent	0.40***	0.000015
R^2	0.48	

**** Significant at 1 percent level.*
NS: Non-significant.

Table 9. Reasons for the purchase of land among farming households

Particulars	Farm size categories					
	Marginal (n_1=4)	Small (n_2=7)	Semi-medium	Medium (n_4=18)	Large (n_5=4)	Total (N=46)
To increase the size of operational holdings	2 (50.00)	2 (28.57)	7 (53.84)	13 (72.22)	3 (75.00)	27 (58.69)
For non-agricultural purposes	1 (25.00)	1 (14.28)	5 (38.46)	7 (38.88)	2 (50.00)	16 (34.78)
Construction of house	3 (75.00)	2 (28.57)	7 (53.84)	7 (38.88)	2 (50.00)	21 (45.65)
Land attached to their mainland	2 (50.00)	3 (42.85)	8 (61.53)	10 (55.55)	3 (75.00)	26 (56.52)
Income from abroad	1 (25.00)	3 (42.85)	4 (30.76)	8 (44.44)	2 (50.00)	18 (39.13)
Income from livestock	1 (25.00)	2 (28.57)	5 (38.46)	5 (27.77)	3 (75.00)	16 (34.78)

Figures in parentheses are the percentage of the total number of farmers in the respective categories.

progressive trend in the area towards diversified rural economic preferences. Among cultivator buyer, there were small, marginal and semi-medium farmers, who attempted to enlarge their smallholding. Large farmers buying land for cultivation constituted the small percentage of total land because they diversified their economic preferences towards non-agriculture.

FACTORS AFFECTING LAND MARKET

The factors affecting the land sale and purchase market were determined by using linear regression analysis involving explanatory variables. The coefficient of determination for the land sale market was 0.65 indicating the explanatory power of the model. It was observed that sale of agricultural land usually occurs more because of their distress needs and to maintain social status. The linear variables expenditure on social ceremonies (X_1), migration (X_3) and construction of the house (X_5) were significant statistically. The variable expenditure on loan payment (X_2) was significant statistically. The variables of the sale of land indicate that with the increase in expenditure on social ceremonies, loan payment and house construction they were selling their precious land.

The coefficient of determination for land purchase market was 0.47, indicating the explanatory power of the model. The variables like agricultural income (X_2) and income from rent (X_5) were significant statistically. The variable income from abroad (X_3) was non-significant but it has a positive relationship with the land purchase. The demand of land for the agricultural purpose may be low because of low margin and hard farming conditions. Thus it is not surprising to find a negative and non-significant relationship of salary and dairy income in the purchase of land. It was also observed that only semi-medium and medium farmers were dominating in the purchase of agricultural land.

CONCLUSIONS

The study concludes that the small and semi-medium farmers were the major players of land sale market in the study area. The number of purchasers was less as compared to sellers. Semi-medium and medium farmers were the major players in land purchase market. Marginal and small farmers also bought small plots of land for house construction. Semi-medium and medium farmers bought land to increase their size of operational holdings. Farmers also bought agricultural land for non-agricultural uses. Some marginal and small farmers were not earning sufficient income and sold their entire land to repay their old debts. The main reasons for land sold were an expenditure of farmers on debt payment, immigration, house construction and social ceremonies. The ban on social gatherings, free education up to metric level and creation of employment opportunities other than agriculture can give a fillip to check this phenomenon. So, it is suggested that the farmers may initiate the joint farming system especially the marginal and small farm households.

REFERENCES

Awasthi, K.M. (2009). Dynamics and resource use efficiency of agricultural land sales and rental market in India. *Land Use Policy 26*(3), 736-743.

Bera, S. (2015). Small farmers struggle for survival in Punjab. *Live Mint*. Retrieved from http://www.livemint.com/Politics/dxGq7XMNUZW9M3mKue2o5I/Small-farmers-struggle-for-survival-in-Punjab.html.

Grewal, S.S., & Rangi, P.S. (1981).An analysis of agrarian structure in Punjab. *Indian Journal of Agricultural Economics, 35,* 173-183.

Mani, G., & Pandey, V.K. (1997). Some policy implications of sales and lease transactions in agricultural land in the progressive area of West U.P. *Indian Journal of Agricultural Economics, 52,* 741-750.

Rai, K.N., & Singh, S.P., Chauhan, R.S., & Niwas, S. (1991). Land market transactions and their impact on the distribution of land in farm families in Haryana. *Indian Journal of Agricultural Economics, 46*(3), 383.

Sarap, K. (1995). Land sale transactions in an Indian village: Theories and evidence. *Indian Economic Review, 30,* 223-240.

Sharma, H.R. (2006). Liberalising the lease market. *Economic and Political Weekly,41,*696-698.

Shergill, H.S. (1986). Land sales and land prices in Punjab. 1952-53 to 1978-79. *Economic and Political Weekly, 38 and 39,* A-125 A-128.

Singh, K., Singh, S., & Kingra, H.S. (2009). Agrarian crisis and depeasantisation in Punjab: Status of small/marginal farmers who left agriculture. *Indian Journal of Agricultural Economics, 64*, 585-603.

Vaidyanathan A (1994). Agrarian relations in the context of new agricultural technology. *Indian Journal of Agricultural Economics, 49,* 317-321.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 234-240
DOI: 10.5958/2322-0430.2018.00063.X

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Impact of Globalization on Transforming India's Economy: A Post Reforms Analysis

Kamlesh Goyal

Research Scholar, Department of Economics, Punjabi University, Patiala-147002 (Punjab)

Corresponding author's email: kamleshg841@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-126* *Revision Accepted: March 07, 2018*

ABSTRACT

Globalization is basically a socio-economic term where people think locally and act globally. It referred to a strategy of economic development where borders of the countries do not matter for movement of commodities, services, capital, finance, labour, technology, ideas, and information. This strategy generates a process of increasing economic integration and growing interdependence between countries of the world economy. Indeed, it isn't only associated with a phenomenal of spread and volume of cross-border economic transactions but also with an organization of economic activities which straddle national boundaries of the world. Indian economy had experienced major policy changes in July, 1991s. The new economic reforms were popularly known as Liberalization, Privatization and Globalization (LPG), aimed at making the Indian economy as the fastest growing economy and globally competitive. The series of reforms has been undertaken with respect to the industrial sector, trade as well as financial sector. This period of economic transition has not only had the tremendous impact on the overall economic development but also on the mindset of Indian people who could get rid of traditional, stubborn thinking, superstition, and illiteracy. As every coin has two sides, similarly, there are both positive and negative aspects of globalization on Indian Economy and this paper analyze the relation between globalization and Indian Economy its implications after post-reform period.

Keywords

Agriculture sector, employment, foreign investment, foreign reserve, foreign trade, globalization, structural transformation.

JEL Codes

F6, F63, F15, F21, F38, N10.

INTRODUCTION

The process of globalization started on a much wider scale with the emergence of capitalism as a universal/dominant system in the world. This generated a very powerful wave in the Nineteenth century and continued into the Twentieth century till the outbreak of First World War (1914-18). This was the period when colonialism was at its peak and the developing world of today was colonies of imperial powers. The process of globalization accelerated by International Monetary Fund (IMF), the World Bank (IBRD) and the US Treasury in the form of an alternative package policy known as "Washington Consensus". Initially, this set of policies was practiced by Ronald Reagon in the US and Margaret Thatcher in Britain. These policies are also known "Neo-liberal" policies. The formation of WTO replacing GATT creates new conditions for better implementation of Washington Consensus. Many new areas/activities, which were earlier not under the ambit of the global trading system, were brought under the purview of WTO. They also included production and trade of agriculture produce, trade in services, Intellectual Property Rights (IPRs), trade related investment measures, etc. At the same time, quantitative trade barriers have been removed and tariff barriers have been decisively brought down. The exports subsidies have also been brought down as they are regarded as trade distorting in nature. In addition, WTO has been empowered to establish dispute settlement mechanism to sort out dispute among the trade partners called counteracting parties (Goyal & Singh, 2016; Goyal, 2016; Nurkse, 1953).

DATA SOURCES AND METHODOLOGY

This study is based on Secondary data taken from various National and International published Reports,

published and unpublished work of individual scholars, articles, research papers, monograph, lectures of different authors from various Journals, Books, News Papers, Periodicals, Magazines, World Bank databank, UNCTAD data bank, etc. The data has been extracted from all the above data sources and analyzed by using percentage, annual growth rate, combined annual growth rate and other statistical tools and has been presented by using tables, graphs, etc. wherever required. This study mainly concentrates on the period from 1990 onwards.

Globalization and Indian Economy

The policies of IMF, World Bank, GATT, 'Washington Consensus' and WTO have transformed the Indian economy. As every coin has two sides, similarly, there is both positive and negative impact so f globalization on Indian economy. While globalization is a catalyst for and a consequence of economic development and a messy process that creates significant challenges and problems. When people criticize the effects of globalization, they generally refer not only to economic globalization but also to other types of concerns, which have emerged over the quality of opportunity and unequal distribution of benefits of globalization. Many poor countries and poor people in many countries have not been able to take full advantage of opportunities brought about by globalization (Gill *et al.*, 2010; Nayak *et al.,* 2005; Nayyar, 1995; Rosentein-Rodan, 1943).

The Indian economy was in deep crisis in July 1991 when foreign currency reserves had plummeted to almost $1 billion; inflation had reported to an annual rate of 17 percent; the fiscal deficit was very high and had become unsustainable; foreign investors and NRIs had lost confidence in Indian economy. The capital was flowing out of the country and the country was close to defaulting on loans. Along with these bottlenecks at home, many unforeseeable changes swept the economies of nations in Western and Eastern Europe, South East Asia, Latin America and elsewhere, around the same time. These were the economic compulsions at home and abroad that called for a complete overhauling of our economic policies and programmers (Somalkar, 2006).

The series of reforms were undertaken with respect to the industrial sector, trade as well as financial sector to make them efficient. With the onset of reforms to liberalize the Indian economy in July 1991,popularly known as Liberalization, Privatization and Globalization (LPG) aimed at making the Indian economy a fastest growing economy and globally competitive. This period of economic transition has a tremendous impact on the overall economic development of almost all the major sectors of the economy, and its effects overlooked besides, it also marks the advent of the real integration of the Indian economy into the global economy. In the Uruguay round of negotiations of GATT 1994, India signed the agreement on trade related investment measures that has forced India to do away with the protection of Indian industry from several global competitions within five years. Of the 13 investment measures that were identified to distort global trade, India has been using as many as eleven of them to meet the needs of social and economic development of the country. The signing of this agreement is bound to remove these much-needed measures. In the meantime the customs duties on imports have been steadily brought down as per the Industrial Licensing Policy 1991 subsequently, in January 1995 as a founder member of GATT; India joined WTO and agreed to stand by the regulatory framework of free global trade and competition (Nayak *et al.,* 2005).

The UPA government headed by Dr. Manmohan Singh was in power for the two consecutive terms since 2004 which was a golden phase in manufacturing, and employment rate increased in growth in India. By the opening of trade, it leads to the creation of new jobs but only imports induced jobs. Manufacturing employment growth has been of intense debate in India. The dismal record of Dr. Singh's Government was one of the control themes of newly elected NDA Government led by BJP, Prime Minister Narendra Modi who assumed office in May 2014, by campaigning during Lok Sabha election in 2014, in his maiden independence day last year, Prime Minister Narendra Modi announced the *Make in India* initiative to unleash Indian manufacturing powers on the global level by attracting global investment in India. The foreign policy of Modi Government appears geared to reinvent India as a more competitive, confident and secure country. A robust foreign policy, however, can sustain itself only on the foundation of a strong domestic policy, a realm where Mr. Modi must prove he can help transform India (Mukherjee, 2016; Nayyar, 1995a; Singh, 2012).

No Prime Minister participated in so many high-powered multilateral and bilateral summits in their first months in office as Mr. Modi. U.S. President Barack Obama's high-profile visit in January on Republic Day will keep national attention on diplomacy. To create an ease of doing business environment by changing a lot of legislative and administrative laws, changes have been taken made by NDA government led by BJP, scrapping the Planning Commission and establish the new institution, National Institute for Transforming India (NITI AYOAG), implementing Minimum Alternative Tax (MAT), etc. The foreign visits of Prime Minister Narendra Modi also show the increasing process of globalization in India by multilateral and bilateral trade and another agreement and MOU's with various countries, governments. The BJP Government also wants amendments in lot of legislation like simplification the tax structure of India by implementing Goods and Service Tax (GST), allowing 100 percent FDI in the almost all the areas of the economy, amendment of land acquisition system in India to create the environment for ease of doing business and to enhance the trade by 'Make in India' scheme (Chellaney, 2016; Goyal & Singh, 2016).

Impact of Globalization on Indian Economy

Globalization in India had a favourable impact on the overall growth rate of the economy. The major improvement gave a Philip to India's growth rate in 1970's which was very low at 3 percent and GDP growth rate in the countries like Brazil, Indonesia, South Korea and Mexico was then twice, that of India. Though India's average annual growth rate almost doubled which was lower than Korea and Indonesia. The acceleration in GDP growth had helped India to improve its global position consequently India's global position has improved from 8th rank in 1991 to 4th rank in 2001, when GDP is calculated on purchasing power parity (PPP) basis. As a result of the balance of payments crisis in 1991, growth in GDP which collapsed to 13 percent in 1991-92 gained momentums thereafter in the next 5 years period (1992-2001), the annual average growth rate in GDP achieved was 6.1 percent. However, in the 10th plan period as a whole (2002-07) average annual growth achieved 7.8 percent. Besides, in the last three years of the 10th plan (2005-06, 2006-07 and 2007-08) growth rate in GDP rose to 9.5, 9.6 and 9.3 percent respectively. Thus, it was claimed that policy of liberalization and globalization has accelerated economic growth. However, under the impact of the crisis of 2008-09 GDP growth rate fell to 6.7 percent in 2008-09. It was because of fiscal stimulus provided by the government and expansionary monetary policy of RBI that economic growth could be revived to 8.6 percent in 2009-10 and 9.3 percent in 2010-11. However, due to adverse global factors such as the slowdown in US economic growth and recession in European countries and Euro-zone crisis affected our export growth in several months. As a result, our economic growth was badly affected. The growth rate in 2011-12 fell to 6.2 percent and in 2012-13 to 5 percent lowest in a decade. The volatility of capital flows added to uncertainty. In 2013-14, the growth rate is also expected to be around 5 percent. It is thus evident that globalization could not ensure the sustained rate of higher economic growth. In 2013-14 Indian economy is said to be in crisis due to the operation of mainly global factors (Ministry of Finance, 2015; Mukherjee, 2016).

Structural Transformation

Due to globalization not only GDP increased but the growth in the sectors of the economy also changed. Earlier the maximum contribution was by the primary sector in GDP which has now been overtaken by the service sector is devotion the maximum part of GDP. The service sector remains the growth driver of the economy with the contribution of more than 57 percent. India is ranked 18th among the world leading exporter of the services with a share of 1.3 percent of the world total exports. The service sector is expected to benefit from the on-going liberalization of foreign investment regime into the sector. Software and Business Process Outsourcing (BPO) sector recorded an exponential growth in the recent year (Reddy, 2013; Sharma, 2012).

Agriculture Sector

The agriculture sector has been and still remains the backbone of the Indian economy. It plays a vital role not only in providing food and nutrition to the people but also in the supply of raw material to industries and to export trade. In 1951, agriculture provided employment to 72 percent of the population and contributed 59 percent of the gross domestic product. However, by 2001 the population depending upon agriculture came to 58 percent whereas the share of agriculture in the GDP went down drastically to 24 percent and further to 22 percent in 2005-10. This has resulted in a lowering the per capita income of the farmers and increasing the rural indebtedness. The agricultural growth of 3.2 percent observed from 1980 to 1997 decelerated to two percent subsequently. The Approach to the Eleventh Five Year Plan released in December 2006 stated that the growth rate of agricultural GDP including forestry and fishing is likely to be below two percent in the Tenth Plan period. A distorted incentive system and low post-harvest value addition continued to be a drag on the performance of the sector. With more than half the population directly depending on this sector, low agricultural growth has serious implications for the inclusiveness of growth (*Economic Survey*, 2015).

Employment

Globalization had an adverse effect on the growth of employment. All the three unemployment rates, namely, unusual status, weekly status and daily status, based on National Sample Survey, increased during the period post-economic reforms whereas they had declined earlier. The basis of current daily status (CDS) (unemployment on an average in the reference week) the rate of unemployment which was 6.1 percent in 1993-94, rose to 7.3 percent in 1999-2000 and further to 8.3 percent in 2004-05. With this, the number of unemployed which was 20 million in 1993-94 went up to 26.7 million in 1999-2000 and further to 34.7 million in 2004-05. It may be noted that the growth of employment, according to National Sample Surveys, in the post-reform period from 1999-2000 to 2004-05 increased by 2.62 percent annum as against 1.25 percent in 1993-94 to 1999-2000. But all this growth of employment was in the unorganized and informal sector. The rate of growth of employment in the organized sector in the post-reform period 1994-2008 has been found to be only 0.05 percent per annum whereas during the pre-reform period (1983-94) employment grew at 1.2 percent per annum. The post-reform period has negative employment growth in the public sector, employment in the organized private sector showed some acceleration in employment growth from 0.44 percent per annum during 1983-94 to 1.75 percent per annum during 1994-2008. However, since the labour force grew at a higher rate of 2.84 percent per annum than the growth in employment during this period the unemployment rate on current daily status (CDS) basis increased from 7.3 percent in 1999-2000 to 8.3 percent in 2004-05. However, in NSSO surveys for the years 2009-10 and 2011-12 unemployment on current daily status (CDS) basis fell to

6.6 percent and 5.6 percent of labour force respectively.

In fact, even some large-scale corporate firms cut down jobs. There has been jobless growth is revealed by 68th round of special employment and unemployment survey, 2011-12. This latest 68th NSSO survey reveals that the percentage of employed persons in the total population declined in 2011-12. According to this, on the basis of usual principal and subsidiary status approach the proportion of population gainfully employed for better part of the year fell from 36.5 percent of the population in 2009-10 to 35.4 percent in 2011-12 despite GDP growth of 8.6 percent in 2009-10, 9.3 percent in 2010-11 and 6.2 percent in 2011-12. Though in percentage terms fall in employment appears to be small, in absolute numbers, it will amount to several lakhs. As a result, usual principal and subsidiary status unemployment rose from 2.5 percent in 2009-10 to 2.7 percent in 2011-12 (Goyal & Singh, 2017; Mukherjee, 2016; NSC, 2012; NSSO, 2012).

Foreign Trade

The perusal of table1 shows the international trade position of India since 1991 (the period of great reforms). The combined annual growth rate of exports is less (17.8 percent) than imports 19.2 percent and balance of trade is growing at a negative pace -26.2 percent annually. In terms of annual growth rate the highest growth rate of exports was highest 35.2 percent in 2010-11, followed by 29.9 percent in 1993-94,it was 28.2 percent, in 2008-09,and it was lowest in 2009-10 about 0.6 percent followed by 2001-02 was 2.7 percent. The annual growth rate of India's imports was maximum in 2004-04 (39.5 percent) followed by 2011-12 was 39.3 percent, 1995-96 was 36.4 percent and 2007-08 was 35.8 percent and lowest was in 2009-10 -0.8 percent, the year after world economic crisis where both imports and exports of India was very low. The position of balance of trade of India after 1991 was in deficit in almost all of the years. The maximum deficit was in the year, 1993-94 that was -65.4 percent followed by -51 percent in 2000-01 and -21.7 percent in 2013-14.

Foreign Investment

An examination of table 2 indicates the foreign investment position of India after 1991 in terms of foreign direct investment (FDI), foreign portfolio investment (FII) and foreign investment net inflows and outflows. The combined annual growth rate from (1990-91 to 2013-14) of foreign direct investment inflows was 34.9 percent and FDI outflows were 41.6 percent, out of this the maximum

Table 1. International trade performance of India since 1991

(₹Crores)

Year	Exports		Imports		Balance of Trade	
1991-92	440.42		478.51		-38.09	
1992-93	536.88	(21.9)	633.75	(32.4)	-96.86	(154.3)
1993-94	697.51	(29.9)	731.01	(15.3)	-33.50	(-65.4)
1994-95	826.74	(18.5)	899.71	(23.1)	-72.97	(117.8)
1995-96	1063.53	(28.6)	1226.78	(36.4)	-163.25	(123.7)
1996-97	1188.17	(11.7)	1389.20	(13.2)	-201.03	(23.1)
1997-98	1301.01	(9.5)	1541.76	(11.0)	-240.76	(19.8)
1998-99	1397.53	(7.4)	1783.32	(15.7)	-385.79	(60.2)
1999-00	1595.61	(14.2)	2152.37	(20.7)	-556.75	(44.3)
2000-01	2035.71	(27.6)	2308.73	(7.3)	-273.02	-(51.0)
2001-02	2090.18	(2.7)	2452.00	(6.2)	-361.82	(32.5)
2002-03	2551.37	(22.1)	2972.06	(21.2)	-420.69	(16.3)
2003-04	2933.67	(15.0)	3591.08	(20.8)	-657.41	(56.3)
2004-05	3753.40	(27.9)	5010.65	(39.5)	-1257.25	(91.2)
2005-06	4564.18	(21.6)	6604.09	(31.8)	-2039.91	(62.3)
2006-07	5717.79	(25.3)	8405.06	(27.3)	-2687.27	(31.7)
2007-08	6558.64	(14.7)	10123.12	(20.4)	-3564.48	(32.6)
2008-09	8407.55	(28.2)	13744.36	(35.8)	-5336.80	(49.7)
2009-10	8455.34	(0.6)	13637.36	(-0.8)	-5182.02	(-2.9)
2010-11	11429.22	(35.2)	16834.67	(23.4)	-5405.45	(4.3)
2011-12	14659.59	(28.3)	23454.63	(39.3)	-8795.04	(62.7)
2012-13	16343.18	(11.5)	26691.62	(13.8)	-10348.44	(17.7)
2013-14	19050.11	(16.6)	27154.34	(1.7)	-8104.23	(-21.7)

Source: Economic Survey 2014-15. ** Figures in parentheses indicates annual growth rate in percentage.

annual growth rate of FDI inflows was 447.4 percent in 1992-93. followed by 160.2 percent in 2006-07 (By 2003-2004 the non-comparability of the Indian FDI statistics was addressed by a committee constituted in May 2002 by Department of Industrial Policy & Promotion (DIPP), in order to bring the reporting system of FDI data in India into alignment with international best practices), 107.7 percent in 1994-95 (pre WTO year) and 27.1 percent 2013-14, the highest negative annual growth rate of FDI inflows was in the year 2002-03 was -21.8 percent followed by -20.8 percent in 1998-99 and -5.2 percent in 2012-13.FDI outflows annual growth rate was highest in 24713.9 percent in 2006-07 (when the new definition of FDI has been adopted) followed by 384.2 percent in 1992-93 and 46.7 percent in 2013-14; it was zero in the year 2003-04 and maximum negative in 92 percent in 1999-2000 and 25.1 percent in 2012-13. The net foreign investment in India was maximum in 1992-93 that was 829 percent followed by 681.3 percent in 1993-94 and 583.6 percent in 2009-10 in terms of annual growth rate, it was negative -37.3 percent in 2013-14 and -50.9 percent in 1997-98.

Foreign Exchange Reserves and Gross National Product

The perusal of table 3 reveals the position of foreign exchange reserves and its relation with gross national product from 1991 to 2013-14. Foreign exchange comprises gold, RTP Reserve Tranche Position in IMF, special drawing rights and foreign currency assets. The combined annual growth of foreign exchange reserves from (1991-92 to 2013-14) was 20.8 percent and 8.5 percent of the gross national product. In terms of annual growth rate, the maximum growth rate of foreign exchange reserves was 96.5 percent in 1993-94, whereas in the same year GNI (constant prices) was growing at 4.9 percent, followed by 32 percent in 1994-95, and 15.1 percent in 2013-14 of foreign exchange reserves. The highest annual growth rate of the gross national product was 10.6 percent in 2007-08 (year of world economic recession) throughout where the foreign exchange was 42.6 percent.

CONCLUSIONS

The process of globalization is hamstrung as there are misgivings, some are genuine and some are imagined. Globalization has positive as well as negative impact on Indian Economy. On the positive side of globalization has accelerated the growth rate of GDP by which now India is the 12th largest economy in terms of the exchange rate (US Dollar) and second fastest growing economy in the

Table 2. Foreign investment inflows and outflows in India since 1991: (in ₹ Crore)

Year	Foreign Direct Investment (FDI) (inflows)		Foreign Direct Investment (FDI) (outflows)		Foreign Direct Investment (FDI) (Net)	Portfolio Investment (FII) (Net)		Foreign Investment (Net)	
1990-91	192		19		173	10		183	
1992-93	1051	447.4	92	384.2	959	741	7310	1700	829.0
1993-94	2042	94.3	203	120.7	1839	11445	1444.5	13282	681.3
1994-95	4241	107.7	25	-87.7	4216	11233	-1.9	15087	13.6
1995-96	7316	72.5	101	304.0	7215	9097	-19.0	15662	3.8
1996-97	10171	39.0	76	-24.8	10094	11735	29.0	21161	35.1
1997-98	13317	30.9	124	63.2	13194	6767	-42.3	19832	-6.3
1998-99	10550	-20.8	163	31.5	10387	-219	-103.2	9737	-50.9
1999-00	9409	-10.8	13	-92.0	9396	13105	-6084.0	22184	127.8
2000-01	18513	96.8	99	661.5	18414	12609	-3.8	27245	22.8
2001-02	29212	57.8	20	-79.8	29192	9617	-23.7	31877	17.0
2002-03	22853	-21.8	278	1290.0	22575	4679	-51.3	21918	-31.2
2003-04	19830	-13.2	0	-100.0	19830	51898	1009.2	62842	186.7
2004-05	27134	36.8	287	0.0	26947	41419	-20.2	58057	-7.6
2005-06	39457	45.4	273	-4.9	39457	55357	33.7	68782	18.5
2006-07	102652	160.2	67742	24713.9	34910	31881	-42.4	66791	-2.9
2007-08	139420	35.8	75644	11.7	63776	110619	247.0	174395	161.1
2008-09	190600	36.7	90500	19.6	100100	-65000	-158.8	35100	-79.9
2009-10	157819	-17.2	71835	-20.6	85984	153967	-336.9	239951	583.6
2010-11	132358	-16.1	78257	8.9	54100	139381	-9.5	193482	-19.4
2011-12	154961	17.1	51794	-33.8	103167	85571	-38.6	188738	-2.5
2012-13	146954	-5.2	38768	-25.1	108186	146467	71.2	254653	34.9
2013-14	186830	27.1	56860	46.7	129970	29680	-79.7	159650	-37.3

Source: Economic Survey, various issues, & RBI. ** In Annual Growth Rate in Percentage in every column.

Table 3. Foreign exchange reserves and gross national product, 1991-92 to 2013-14

(₹ Crore)

Year	Gold	RTP	SDRs	Foreign currency assets	Total		Gross national income at market prices (Constant prices) 2004-05 series	
1991-92	9039	---	233	14578	23850		1485707	(5.3)
1992-93	10549	---	55	20140	30744	(28.9)	1567944	(5.5)
1993-94	12794	---	339	47287	60420	(96.5)	1644886	(4.9)
1994-95	13752	---	23	66006	79781	(32.0)	1755272	(6.7)
1995-96	15658	---	280	58446	74384	(-6.8)	1888228	(7.6)
1996-97	14557	---	7	80368	94932	(27.6)	2032837	(7.7)
1997-98	13394	---	4	102507	115905	(22.1)	2118975	(4.2)
1998-99	12559	---	34	125412	138005	(19.1)	2250012	(6.2)
1999-00	12973	---	16	152924	165913	(20.2)	2448654	(8.8)
2000-01	12711	---	11	184482	197204	(18.9)	2535911	(3.6)
2001-02	14868	---	50	249118	264036	(33.9)	2661819	(5.0)
2002-03	16875	3190	19	341476	361470	(36.9)	2766298	(3.9)
2003-04	18216	5688	10	466215	490129	(35.6)	2983497	(7.9)
2004-05	19686	6289	20	593121	619116	(26.3)	3219835	(7.9)
2005-06	25674	3374	12	647327	676387	(9.3)	3518348	(9.3)
2006-07	29573	2044	8	836597	868222	(28.4)	3841974	(9.2)
2007-08	40124	1744	74	1196023	1237965	(42.6)	4233768	(10.2)
2008-09	48973	5000	6	1230066	1283865	(3.7)	4390966	(3.7)
2009-10	81188	6231	22596	1149650	1259665	(-1.9)	4763090	(8.5)
2010-11	102572	13158	20401	1224883	1361013	(8.0)	5227739	(9.8)
2011-12	138250	14511	22866	1330511	1506139	(10.7)	5586683	(6.9)
2012-13a	139737	12513	23538	1412631	1588419	(5.5)	9172925*	(4.8)
2013-14a	129616	11019	26793	1660914	1828342	(15.1)	9800813*	(6.8)

*Source: Economic Survey 2014-15. **Figures in parentheses indicates annual growth rate in percentage. (a) Advance estimates. *measured on 2011-12 prices. RTP: Reserve Tranche Position in IMF.*

world. India's GDP has touched the US $1.25 trillion. India made a remarkable progress in information technology, services, and knowledge process services. Due to globalization not only GDP increased but the growth in the sectors of economy also changed. Earlier the maximum contribution was by the primary sector in GDP which has now been overtaken by the service sector is devotion the maximum part of GDP. On the negative side, globalization had an adverse effect on the growth of employment. All the three unemployment rates, namely, unusual status, weekly status and daily status, based on National Sample Survey, increased during the period post-economic reforms whereas they had declined earlier even that period of growth showing jobless growth. Indeed, globalization has also generated high inequalities among Indian people where only a few people who are exploiting the resources of the economy and most of the proportion of national income is possessed by them. This type of unequal distribution of income leads to the marginalization of some groups, causing large-scale unemployment and inequalities, as also an upsurge of consumerism and damage to the environment. If adopted without checks it can cause loss to country's sovereignty. It is also presumed that free market system tends to become a source of economic and political corruption. India's experience so far has been mixed. How far the country's nation-builders take us is still under an interrogation mark.

SUGGESTIONS

Since the independence, the share of employment was high in the agriculture sector, so there is need to give special attention to the agriculture sector. New agro-processing plants should be established at different places to boost agricultural growth. Due to globalization, the share of service sector in GDP is increasing but in terms of employment generation, it is lagging behind. Therefore, such policies and rules should be adopted in the service sector that can generate employment. The policies of Government of India should be able to push foreign direct investment into manufacturing sector and high

technology areas through which the Indian economy can effectively be part of the globalization process worldwide.

REFERENCES

Chellaney, B. (2016). Deconstructing the Modi foreign policy. *The Hindu*, p. 10. Retrieved from http://www.thehindu.com/todays-paper/tp-opinion/deconstructing-the-modi-foreign-policy/article6660012.ece.

Gill, S.S., Singh, S., & Brar, J. S. (2010). *Globalization and Indian state education, health and agriculture extension services in Punjab*. Delhi: Aakbar Books, Delhi.

Goyal, K. (2016). *Globalization and its impact on transforming India's economy*. Punjabi University, Patiala.

Goyal, K., & Singh, K. (2016). India in the process of globalization. *Political Economy Journal of India*, *25*(3 and 4), 69–74.

Goyal, K., & Singh, K. (2017). Globalisation and its impact on informal sector in India. *Man and Development*, *39*(3), 69–84.

Ministry of Finance. (2015). *Economic survey, 2015.* Ministry of Finance, Government of India, New Delhi. Retrieved from http://mofapp.nic.in:8080/economicsurvey/.

Mukherjee, S. (2016). Globalization and Indian economy. Retrieved from http://www.economicsdiscussion.net/globalization/india-globalization/globalisation-and-india-economy/10945

Nayak, A.K.J.R., Chakravarti, K., & Rajib, P. (2005). Globalization process in India: A historical perspective since independence, 1947. *South Asian Journal of Management*, *12*(1), 7–22. Retrieved from http://search.proquest.com/docview/222720235?accountid=169017

Nayyar, D. (1995). *Economic liberalization in Indian economy: Analytics, experience, and lesson*. Calcutta: Orient.

Nayyar, D. (1995a). Globalization: The past in our present. *Indian Economic Journal*, *43*(3), 1–18.

NSC. (2012). *Report of the Committee on Unorganized Sector*. New Delhi.

NSSO. (2012). *Informal sector and conditions of employment in India.* New Delhi.

Nurkse, R. (1953). *Capital formation in under-developing countries*. New York: Oxford University Press.

Reddy, Y. V. (2013). Understanding economic reforms for India. *Indian Economic Review*, *48*(1), 33–38.

Rosentein-Rodan, P. N. (1943). Problems of industrialization of Eastern and South-Eastern Europe. *The Economic Journal*, *53*(210–211), 202–211.

Sharma, A. (2012). *Globalization, the balance of payments and foreign exchange reserves in India: A post-reform study*. Maharshi Dayanand University Rohtak, Haryana. Retrieved from http://shodhganga.inflibnet.ac.in/handle/10603/44852

Singh, S. (2012). Globalization and its impact on Indian economy. *Arth Prabhat: A Journal of Economics and Management*, *1*(1), 37–47.

Somalkar, P. (2006). Impact of globalization on Indian economy. *ABHINAV National Monthly Refereed Journal of Research in Arts and Education*, *1*(8), 5–11.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 241-246
DOI: 10.5958/2322-0430.2018.00064.1

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Price Spread and Marketing Efficiency in the Marketing of Rapeseed and Mustard in Bathinda District of Punjab

*Kamalpreet Kaur and Parminder Kaur**

Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141004

**Corresponding Author: p_kaur366@yahoo.in*

Received: January 15, 2018 *Manuscript Number: NS-18-131* *Revision Accepted: March 10, 2018*

ABSTRACT

The results revealed that the marketed surplus on large farms came out to be 95.09 percent followed by small (90.53 percent) and medium (89.67 percent) farms. The price spreads in Sangat market (₹8008.90) was found to be more than Raman market (₹7953.90) in Channel-I (Producer-Processor-Oil wholesalers-Oil retailers-Consumers). Producer's share in consumer rupee in Channel-II was found more as compared to both the markets in Channel-I as none of intermediaries were involved in this channel. Fluctuation in prices, problems in weighing of the produce, dominance of traders, delayed payment, movement of stray animals in the markets, lack of proper shed were important marketing constraints. The study brought out that as the marketing margins of the processors were found to be the highest, farmers should make efforts to add value to their produce at their own on cooperative basis in order to get more share in consumer's rupee. 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.

Keywords
Consumption, marketing efficiency, price spread, production, rapeseed and mustard.

JEL Codes
M31, Q13, Q18.

INTRODUCTION

Rapeseed and mustard is the major oilseeds crop of the *rabi* season in India. Although rapeseed and mustard is cultivated in 13 states, production in Rajasthan, Uttar Pradesh, Haryana and West-Bengal with their respective share of 45, 13, 11 and 8 percent accounts for 77 percent of the total production of rapeseed and mustard in the country (Directorate of Economics and Statistics, 2015). This crop accounts for nearly one-third of the oil produced in India, making it the country's key edible oilseed crop. This group of oilseed crops is gaining wide acceptance among the farmers because of adaptability for both irrigated as well as rainfed areas and suitability for sole as well as mixed cropping. Besides, it offers higher return with low cost of production and low water requirement.

India was self-sufficient in edible oilseeds and oil till the mid-60s and was a substantial export earner through export of oilseeds, meals extractions, and edible oils. With stagnation in production as well as rise in population, the oilseed production fell short of its demand in the early seventies. By the mid-80s, edible oils was the largest importitem, constituting about 30 percent of the total supply, next only to petroleum products despite the fact that India had the world's second largest area under oilseeds. This was a matter of serious concern for the Government and a decision was taken to achieve self-sufficiency in edible oilseeds by 1990s.The initial strategy to overcome stagnant oilseed production was to promote technological change in oilseed production and processing through centrally sponsored schemes. As a result of major initiatives in mid-1980s onwards the production of oilseeds in the country increased during the recent years and reached a level of about 31.16 million tonnes in TE (Triennium Ending) 2013-14. The annual compound growth rate in oilseeds production was negative (-1.96 percent) between 1994-95 and 2000-01 but improved significantly (6.85 percent) during the 2000s. The average productivity increased from 872

kg/ha in TE 2000-01 to 1156 kg/ha in TE 2013-14 (Directorate of Economics and Statistics, 2015). However, the productivity levels of oilseeds in the country are still very low compared to world average and other countries. The major avenues for future increases in oilseeds production are expected to come from enhancement in productivity of oilseed crops. 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 oilseed crops, a combination of land-saving technologies involving high-yielding varieties and hybrids and an efficient crop management needs to be adopted. The present scenario calls for some urgent measures to be taken to step up oilseeds production on a sustainable basis since the growth in oilseeds production has not kept pace with their increasing demand.

On an average, the country produces about six percent of rapeseed and mustard 'seed' annually and 80 percent of this is marketed by the small-scale sector in loose form, with only 20 percent sold by the organized sector (Sharma, 2014). A major portion of seeds enters the regulated markets and is purchased by oilseed crushers for oil extraction and production of oil meal. Rapeseed and mustard is the largest consumed oil accounting for about 26 percent of the total edible oil produced domestically. Major consuming states of rapeseed and mustard oil in India are Gujarat, Maharashtra, Rajasthan and Madhya Pradesh accounting nine percent, Delhi, Punjab, Jammu &Kashmir, Himachal Pradesh and Uttar Pradesh accounting 25 percent and East-West Bengal, Orissa, Bihar, Assam, Chhattisgarh, Jharkhand accounting about 30 percent. The oil content in rapeseed and mustard typically varies between 36 and 45 percent. Once the oil is extracted, the remaining part of the seed is used to produce meal, an important source of cattle and poultry feed. India exports about seven million metric tonnes of seed meals adding about ₹11000 crore to the national economy. After soybean, rapeseed and mustard meal accounts for about 37.5 percent of the total seed meal exported from the country (Kumar, 2014).

In India, although personal income derived from agriculture is exempted from income tax, central and state governments generate revenues from oilseed sector by means of several taxes including intra and interstate sales tax by seller, about four percent of value added tax in many states about eight percent excise duty on branded and packed edible oils by oilseeds crushers. Municipalities may also charge *octroi* duties, to varying degrees, for rapeseed and mustard oil products entering their markets. But in some states charges fixed by the *mandi* committee are levied for activities such as loading, unloading, weighing, brokerage, and cleaning.

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 while the average yield is about 1306 kg/ha in 2013-14 (Economic Advisor, 2014). The produce of rapeseed and mustard is marketed through different marketing channels involving large number of intermediaries. Hence, there are wide variations in the prices of rapeseed and mustard from producers to consumers. It is felt that farmers are not getting remunerative price of their produce. It becomes necessary to examine the marketing costs, margins of different channels from time to time. In this backdrop, the present study was undertaken with the following specific objectives:

i. to examine the production, consumption and marketed surplus of rapeseed and mustard on different size categories of farms in Bathinda district,
ii. to estimate the marketing costs, margins, and marketing efficiency in different channels of marketing of rapeseed and mustard, and
iii. to analyze the constraints associated with the marketing of rapeseed and mustard in the study area.

METHODS AND MATERIALS

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 southwestern 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 landholding 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. To analyze the price spread in the marketing of rapeseed and mustard, two markets namely Raman and Sangat were selected on the basis of highest quantitative arrivals of rapeseed and mustard. A list of various market functionaries operating in the selected markets was prepared. A random sample of ten intermediaries each namely, processors, oil-wholesalers, oil retailers were selected from both markets. A sample of 20 consumers from the study area was therefore selected randomly to examine the actual price paid per quintal of rapeseed and mustard and the share of different agencies in consumer's rupee.

Primary data were collected from the sample households for the year 2015-16. Data were collected

from the sample respondents on the pre-structured and pre-tested schedules by a personal interview method.

Concepts Used

Marketed surplus

It is the quantity which the producer actually sells respective of his needs for home consumption and other requirements.

Marketing channels

These refer to the chains of intermediaries through which rapeseed and mustard pass on from the producer to ultimate consumers.

Producer's share in consumer rupee

It is the price received by the farmer expressed as a percent of the retail price (price paid by the consumer). The producer's share in consumer's rupee may be expressed as follows:

$$Ps \quad \frac{Pf}{\Pr} \quad 100$$

Where,

Ps= Producer's share in consumer's rupee

Pf= Producer's price

Pr= Retail price

Price spread

The price spreads of rapeseed-mustard in the sample market were investigated at a point of time in various marketing channels. The price spread refers to the difference between the price paid by the consumer and the price received by the producer for an equivalent quantity at a given point of time in a specific market.

Marketing margins

Marketing margin is the difference between the total payment (cost + purchase price) and receipt (sale price) of the middlemen.

$$A_{mi} = P_{ri} - (P_{pi} + C_{mi})$$

Where,

A_{mi}=Absolute margin of ith middlemen

P_{ri}= Total value of receipts per unit (sale price)

P_{pi} = Purchase value of goods per unit (purchase price)

C_{mi}= Cost incurred on marketing per unit

Marketing efficiency

Marketing efficiency was calculated by usingAcharya's index of marketing.

Acharya's equation is

ME = FP / (MC+MM)

Where,

ME = Marketing efficiency

FP = Price received by the farmer

MC = Total marketing cost

MM = Net marketing margins

Garrett's Ranking Technique

Garret's Ranking Technique was used to rank the problems perceived by the sampled respondents in the marketing of rapeseed and mustard. The degree of response with regard to problems faced by sampled respondents was ranked. The most prevalent problem was given 1st rank and accordingly, the next important problem was ranked on the basis of the severity of the problem.

Percent position= 100*(Rij – 0.5)/Nj

Where

Rij = Rank given for i^{th}items/problems by the Jth respondent

Nj = Number of items/problems ranked by the Jth respondent

The relative position of each rank is converted into scores by referring 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:

Production Consumption and Marketed Surplus of Rapeseed and Mustard

It has been found that selected farmers retained rapeseed and mustard crop for home consumption and for seed. The perusal of Table 1 reveals that rapeseed and mustard produce used for home consumption by medium farmers was 10.06 percent of the total produce followed by the small (8.81percent) and large farmers (4.70 percent) with overall average of 8.90 percent. It was observed that medium farmers retained higher percentage of produce for home consumption as compared to small and large farmers. The small farmers kept 0.66 percent of the produce for seed purposes for the next crop. The same for the medium and large farmers was 0.27 and 0.21 percent respectively. The marketed surplus was higher in case of large farms (95.09percent) as compared to small (90.53 percent) and medium (89.67percent) because large farms retained less produce for home consumption and seed use.

Marketing of Rapeseed and Mustard

This section deals with the analysis of marketing

Table 1. Production, consumption and marketed surplus of rapeseed and mustard on the sampled farms in Bathinda district, Punjab, 2015-16

(q/farm)

Particulars	Farm size categories			Overall
	Small	Medium	Large	
Total production	4.54 (100.00)	14.91 (100.00)	42.53 (100.00)	13.15 (100.00)
Utilization	0.43 (9.47)	1.54 (10.33)	2.09 (4.91)	1.21 (9.20)
Home consumption	0.40 (8.81)	1.50 (10.06)	2.00 (4.70)	1.17 (8.90)
Seed	0.03 (0.66)	0.04 (0.27)	0.09 (0.21)	0.04 (0.30)
Marketed surplus	4.11 (90.53)	13.37 (89.67)	40.44 (95.09)	11.94 (91.05)

Figures in parentheses are percentages to their respective totals.

structure for rapeseed and mustard, price spreads, marketing costs and margins of different intermediaries engaged in the alternative marketing channels of rapeseed and mustard in study area.

Marketing Channels and Price Spread in the Marketing of Rapeseed and Mustard

Marketing of a commodity is an important part of every production process. Marketing channel refer to the path through which a commodity moves from the producer to the ultimate consumer. It is desired that the movement of the goods from producer to consumer should be at the minimum cost consistent with provision of services. The marketing of rapeseed and mustard from producer to consumer involved a number of intermediaries in the study area. Two marketing channels were identified in the study area through which the commodity passed from producer to the ultimate consumer.

Table2. Marketing costs, margins and price spread of rapeseed and mustard in the selectedmarkets of Bathinda district, Punjab, 2015-16
Channel-I Producer-Processor-Oil wholesalers-Oil retailers-Consumers

(₹/q)

Particulars	Raman	Sangat
Net price received by producer	3746.10	3641.10
Costs incurred by producer		
Transportation charges	40.00	45.00
Unloading charges	5.00	5.00
Cleaning charges	8.90	8.90
Total marketing costs of producer	53.90	58.90
Producer's sale price / Processor's purchase price	3800.00	3700.00
Costs incurred by Processor		
Transportation charges	9.00	10.95
Commission fee @ 2.5percent	95.00	92.50
Cost of gunny bags	25.00	35.00
VAT @ 6.88percent	261.44	254.56
Stitching charges	2.48	2.48
Labour charges for loading	3.95	3.95
Labour charges for unloading	10.00	10.00
Processing charges	123.95	133.00
Total marketing costs of processor	530.82	542.44
Processor's sale price /Oil-wholesaler's purchase price	9000.00	9000.00
Processor's margin	4669.18	4757.56
Costs incurred by oil-wholesalers		
Transportation cost	100.00	210.00
Packing cost	300.00	300.00
Electricity charges	300.00	250.00
Labour charges	200.00	200.00
Total marketing costs of oil-wholesalers	900.00	960.00
Oil-wholesaler's sale price / Oil-retailer's purchase price	10500.00	10600.00
Wholesaler's margin	600.00	640.00
Costs incurred by oil-retailers		
Transportation cost	250.00	200.00
Labor cost	200.00	200.00
Total marketing costs of oil-retailers	450.00	400.00
Oil-retailer's sale price /Consumer's purchase price	11700.00	11650.00
Retailer's margin	750.00	650.00
Total marketing costs	1934.72	1961.34
Total marketing margins	6019.18	6047.56
Price spread	7953.90	8008.90
Producer's share in consumer's rupee (percent)	32.02	31.25

Channel–I: Producer–Processor–Oil wholesalers–Oil retailers–Consumers

Channel–II: Producer–Consumer

Marketing Costs and Margins of Rapeseed and Mustard

Channel-I (Producer-Processor-Oil wholesalers-Oil retailers-Consumers)

The marketing costs, margins, and price spread in channel–I in two markets namely Raman and Sangat market of Bathinda district is presented in Table 2. Channel–I was the main channel of marketing of rapeseed and mustard in the study area. The net price received by the producer was ₹3746.10 per quintal in Raman market and ₹3641.10 in Sangat market. Costs incurred by the producer on transportation, cleaning, and unloading were to the tune of ₹40.00, ₹8.90 and ₹5.00 respectively per quintal which was foundalmost the same in both the markets. The costs incurred by processors included commission fee and Vat which were at rate of 2.50, and6.88 percent respectively. Commission fee, Vat, processing charges was estimated at ₹95.00, ₹261.44 and ₹123.95 per quintal respectively in Raman market and ₹92.50, ₹.254.56 and ₹133.00 respectively in Sangat market. The marketing cost borne by oil–wholesalers were transportation cost, packing charges, electricity and labour charges which were estimated to be ₹100, ₹300, ₹300, and ₹200 respectively in Raman market while these costs were ₹210, ₹300, ₹250 and ₹200 in Sangat market. Labour and packing charges were found to be same in both the markets. The electricity charges were found more in Raman market (₹300) than that in Sangat market (₹250).

The oil–retailers incurred only transportation (₹250 per quintal) and labour costs (₹200 per quintal) in Raman market and ₹200 for transportation and labour cost each in Sangat market. The marketing margins of the middlemen in Raman and Sangat markets were estimated to be ₹6019.18 and ₹6047.56 respectively. The total marketing costs incurred in the marketing of rapeseed and mustard through the Channel–I was found more in Sangat market (₹1961.34 per quintal) than the Raman market (₹1934.72 per quintal). The price spread was also higher in Sangat market (₹8008.90) than in Raman market (₹7953.90) because the marketing costs were higher in Sangat market. Producer's share in consumer's rupee was 32.02 percent in Raman market and 31.25 percent in Sangat market.

Channel-II (Producer-Consumer)

Some rapeseed and mustard growers sold a part of their produce directly to consumers on their farms. No marketing cost and transportation cost was incurred by the producer for such sales. It was evident from Table 3 that the producer's sale price or consumer's purchase price was ₹3750 in this channel. This was the most efficient channel of rapeseed and mustard market because the producer's share in consumer's rupee was 100 percent.

Marketing Efficiency

The perusal of Table 4 revealed that the net price received by producers was more in Raman market (₹3746.10) than Sangat market (₹3641.10) channel–I and while it was ₹3750.00 in Channel–II. In channel–I, the sum of marketing costs and margins was more in Sangat market because the margins of processors and oil–wholesalers was more in this market as compared to Raman market. The marketing efficiency of two markets came out to be 0.47 and 0.45 respectively which indicates in this channel Raman market was more efficient than Sangat market.

Marketing Related Constraints

A set of problems was faced by the respondents in the marketing of rapeseed and mustard in study area. Garrett's ranking technique was used to rank the problem on the basis of the severity of problems by giving ranks and the outcome of such ranking was converted into scores value. First rank was given to the problem with highest mean score and lowest rank was given to the minimum mean score.

The perusal Table 5 reveals that according to Garrett's rank technique the movement of stray animals in the market yard was the major problem in Raman and Sangat market of Bathinda district which was at the top rank. The animals like buffaloes, bulls, cows, etc. Move freely in the market and the second rank was given to lack of proper sheds in both markets. Uncovered sheds in the markets create the problem in adverse weather conditions. Due to bad conditions of roads and high cost of transportation,

Table 3. Producer's share in consumer's rupee of rapeseed and mustard in channel-II (Producer-Consumer) in Bathinda district, Punjab, 2015-16

Particulars	₹/q
Producer's sale price	3750.0
Consumer's purchase price	3750.0
Producer's share in consumer's rupee (percent)	100.00

Table 4. Marketing efficiency in different marketing channels of rapeseed and mustard in Bathinda district, Punjab, 2015-16

(₹/q)

Particulars	Channel-I		Channel -II
	Raman market	Sangat market	
Net price received by producer	3746.10	3641.10	3750.00
Marketing costs and margins	7953.90	8008.90	–
Marketing efficiency	0.47	0.45	1.00

Table 5. Perceived constraints in the marketing of rapeseed and mustard in Bathinda district, Punjab, 2015-16

Problems	Total score	Garrett mean score	Rank
Fluctuation in prices	2874	35.93	5
Problems in weighing of the produce	2751	34.39	6
Dominance of traders in market	2088	26.10	8
Delayed payment	2644	33.05	7
Lack of market information	3095	38.69	4
Transportation of produce to the market	3240	40.50	3
Stray animals	4600	57.50	1
Lack of proper shed	4352	54.40	2

farmers faced many problems in the marketing of rapeseed and mustard in Bathinda district and farmers gave it third rank and other problems like lack of market price information, fluctuation in prices, problems in weighing of the produce, delayed payments and dominance of traders in market were given fourth, fifth, sixth, seventh and eighth rank respectively.

CONCLUSIONS AND POLICY IMPLICATIONS

The results revealed that as the number of market functionaries found increased, they add value to the commodity resulted fall in producer's share in consumer's rupee. For direct sale of rapeseed and mustard (Channel–II), the producer got the highest share in the consumer's rupee. The study brought out that the most common marketing problems perceived by the sampled respondents were free movement of stray animals in the markets, lack of proper shed, high transportation cost of production to the market etc. The results showed that as the marketing margins of the processors were found to be the highest, farmers should make efforts to add value to their produce at their own on cooperative basis in order to get more share in consumer's rupee. 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.

REFERENCES

Directorate of Economics and Statistics. (2015). *Agricultural statistics at a glance 2015*. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation and Farmers Welfare, Directorate of Economics and Statistics, Krishi Bhawan, New Delhi.

Economic Advisor. (2014). *Statistical abstract of Punjab*, Economic and Statistical Organization, Government of Punjab, Chandigarh.

Kumar, A. (2014). Challenge of edible oils: Can brassicas deliver? *Journal of Oilseed Brassica,* **5**, 83–86.

Sharma, V.P. (2014). *Problems and prospects of oilseeds production in India*. Report of Centre for Management in Agriculture, Indian Institute of Management, Ahmedabad, India.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 247-251
DOI: 10.5958/2322-0430.2018.00065.3

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Determinants of Consumption and Willingness to Pay for Fermented Probiotic Dairy Products in Metropolitan Delhi

Jagruti Das[1] and R. Raju[2]*

[1]*Research Scholar, Dairy Economics, Statistics, and Management Division, ICAR-National Dairy Research Institute Karnal-132001*
[2]*Scientist, ICAR-Central Soil Salinity Research Institute, Karnal-132001*

[*]*Corresponding author's email: jagrutidas178@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-150* *Revision Accepted: March 13, 2018*

ABSTRACT

The present study attempted to explain the factors which influenced the per capita consumption of fermented probiotic dairy products, using primary data collected from various locations of Metropolitan Delhi. The data for the study was collected by direct personal interview method based on a well-structured schedule. The data on customers' willingness to pay for prominent and popular ones were collected from 250 respondents based on the socio-demographic information of the household. To carry out the functional analysis, Tobit regression model was selected for knowing about the determinants of the consumption pattern of fermented probiotic dairy products. The study revealed that the Marginal Willingness to Pay (WTP) of the respondents for Probiotic Drink is highest at a price of ₹22, for a quantity of 80 ml when purchased from Supermarkets and with a health claim of improving digestion. The most important factors determining the consumers' willingness to pay are governed by the product's purchase location followed by health claims. The Marginal WTP of the respondents for Probiotic Dahi is highest at a price of ₹25, for a quantity of 200 g when purchased from local shops and with a health claim of the immune booster. The most important factors determining the consumers' willingness to pay are governed by the product's purchase location followed by prices. The results of the analysis revealed that income, occupation and food habit of the respondents have the significant influence on monthly per capita consumption of fermented probiotic dairy products.

Keywords
Conjoint analysis, determinants of consumption pattern, fermented dairy probiotics.

JEL Codes
C81, O13, R15.

INTRODUCTION

With an increase in income of the consumers, rising urbanization and better advertisement of the products, the demand for probiotics in India is expected to grow further in the years to come. Yu & Bogue (2013) in their study indicated that the most likely takers for functional foods were young females with higher educational background and relatively higher incomes. Presently, Indian probiotic market is small with an annual figure of 20.6 million Euros, estimated an upcoming projection of 1.3 billion Euros by the end of 2015 (Tech Sci. Research Report).The Indian dairy probiotic market is projected to have a CAGR of 25 percent, during 2014-2019. Govindrao (2013) while studying consumption pattern of functional foods among different income levels in Metropolitan Maharashtra found that the consumption expenditure increased substantially with an increase in household income of the respondents. Dairy-based probiotic functional foods and beverages are the largest segment in the Indian probiotic market, in terms of revenue. There is a need for segmenting the market on the basis of (Competition Strategy) for better targeting the urban consumers, especially the youth in metro cities that are health conscious. Chase *et al.* (2009) studied the purchase behavior of Canadian consumers with regard to innovative functional food products, based on the social-demographic profile of the consumers. They argued that knowledge of the nutritional facts and health benefits

associated with food items were important factors which motivated the consumers to buy these foods.

The determinants of consumption of fermented probiotic dairy products and consumers' willingness to pay for them have not been assessed adequately. The present study has made an effort to address this research gap in Metropolitan Delhi.

METHODOLOGY

Selection of the Study Area

This study was conducted in the Metropolitan Delhi. For detailed investigation, five representative areas were selected namely; Preet Vihar, Janakpuri, Connaught Place, Kamla Nagar and Saket which represents East, West, Central, North and South Delhi respectively.

Sampling Design

The sampling design adopted for the selection of market outlets and respondents from market outlets was purposive multistage random sampling.

From each of these locations of the Metropolitan Delhi, 50 respondents were selected. A total of 250 respondents were interviewed for this study.

Data Collection

The study is based on primary data and supported with secondary data wherever necessary. The data for the study was collected by direct personal interview method based on a well-structured schedule. The data on determinants of consumption and willingness to pay for fermented probiotic dairy products were collected from 250 respondents based on the socio-demographic information of the household. The preferences of the consumer for various combinations of attributes of the products were also collected from the respondents.

Secondary information was collected from various published and unpublished sources which include: market reports, websites and magazine and newspaper articles were consulted to get information on market coverage, composition, and leading player brands in the probiotic dairy industry.

ANALYTICAL FRAMEWORK

Functional Analysis

The present study attempted to explain the factors which influenced the per capita consumption of fermented probiotic dairy products, using primary data collected from various locations of Metropolitan Delhi. The required data for this investigation was obtained by a survey of 250 respondents. The monthly per capita consumption expenditure of households (Y) on fermented probiotic dairy products was considered as a dependent variable. There were five independent variables, out of which two were continuous, viz; an age of the respondent(X_1) and monthly household income of the respondent (X_2). Hence, dummy variables used were food habit of the respondent (D_1), the occupation of the respondent (D_2) and education of the respondent (D_3).

Tobit regression model was used for the analysis as most of the variables used in this study were categorical **in** nature.

Mathematically, the Tobit regression model can be represented as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3D_1 + b_4D_2 + b_5D_3 + u$$

Where,

X_1 = Age

X_2= Family monthly income

D_1= Food habit (0= Vegetarian, 1=Non- Vegetarian)

D_2=Occupation of the respondent (0=Non-Service, 1=Service)

D_3=Education of the respondent (0=below Graduation, 1= Above Graduation)

u= Error term

Assessing the consumers' Willingness to pay for major probiotic products

Willingness to pay is the maximum price that someone is willing to pay to acquire a good or service. The major probiotic products were assessed for consumers' willingness to pay. For assessing the consumers' willingness to pay for the probiotic drink and probiotic dahi, Conjoint Analysis was carried out.

Conjoint Analysis

Conjoint analysis is a multivariate technique developed specially to understand how consumers develop preferences for different products or services. For the accomplishment of this objective, Choice-based Conjoint Analysis was used.The choices were based on quantity of the product, size of the container, health claims, location of purchase, price.

The numbers of combinations obtained were 16 both in case of probiotic drink and probiotic dahi. The respondents were asked to rank these combinations from rank 1 to rank 16 based on their preferences for the product. Rank 1was given to the most preferred combination while rank 16 to the least preferred one. Using random utility framework, consumer behavior model was constructed. The coefficients of the model were used to asses Marginal Willingness to Pay (MWTP).

RESULTS AND DISCUSSION

Major Determinants of Consumption for Fermented Probiotic Dairy Products

The present study attempted to identify the factors which influence the monthly per capita consumption of fermented probiotic dairy products. In general, it is believed that income of the respondent's household, education of the respondent, the age of the respondent, the dietary pattern of the respondent's household and the respondent's occupation affects the per capita monthly consumption of fermented probiotic dairy products. In this study, education, occupation and dietary pattern of the respondents have been used as dummy variables. The per capita monthly consumption expenditure of the respondents' households (Y) on fermented probiotic dairy products was considered as dependent variable and the variables like age of the respondent (X_1), monthly income of the respondent's household (X_2), food habit of the respondent (D_1), occupation of the respondent (D_2) and educational status of the respondent (D_3) were considered

as independent variables.

The results of the analysis revealed that income, occupation and food habit of the respondents have a significant influence on monthly per capita consumption of fermented probiotic dairy products. A unit increase in the respondent's monthly income was causing an increase in monthly per capita consumption of fermented probiotic daily products by ₹0.0020 (Table 1). The fixed income earners (service holders) spent more on fermented probiotic dairy products than those of non-fixed income earners by ₹34.39. The non-vegetarians spent less on the probiotic products than the vegetarians by ₹35.94 (Table 2).

Assessment of Willingness to Pay for Major Fermented Probiotic Dairy Products (Probiotic Drink and Probiotic Dahi)

Conjoint analysis was used to estimate the willingness to pay for major probiotic dairy products like the probiotic drink and probiotic dahi.

Willingness to Pay for Probiotic drink

For estimation of the willingness to pay for the probiotic drink, the following model was considered (Table 3)

The utility index for different levels of the product attributes are represented below (Table 4)

The study revealed that the Marginal WTP of the respondents for Probiotic Drink is highest at a price of ₹22, for a quantity of 80 ml when purchased from Supermarkets and with a health claim of improving digestion. The most important factors determining the consumers' willingness to pay are governed by the product's purchase location followed by health claims (Figure1).

Lahteenmaki & Urala (2007) reported that reward from functional foods revolves around the idea that functional foods give consumers an easier way to live a healthy lifestyle, focusing on the benefits that can be derived from consuming functional foods.

Carrillo *et al.* (2013) confined that the consumers are more inclined to buy functional food if they understand the products health benefits and rewards.

Yu and Bogue (2013) in their study on functional foods found that product attributes which were found to be most important for the respondents were flavour and

Table 2. Factors influencing the monthly per capita consumption on fermented probiotic dairy products

(n = 250)

Variable	Co-efficient	Standard error
Intercept	-53.7902	47.8950
Age	-0.4558	0.9562
Family monthly income	0.0020***	0.0005
Food habit	-35.9446*	18.9106
Occupation	34.3970*	19.5419
Education	34.5420	27.6384

******Significant at p<0.01, *Significant at p<0.1.***

Table 3. Model for determining willingness to pay for the probiotic drink

Attributes	Number of levels	Relation to ranks or scores
Price	2	Discrete
Container size	3	Discrete
Health claims	2	Discrete
Packaging	2	Discrete
Purchase locations	4	Discrete

Table 4. Utility index of various attributes of probiotic drink

Attributes	Levels	Estimated utility
Price (₹)	10	-.106
	22	.106
Container size (ml)	65	-.285
	80	.483
	200	-.197
Health claims	Improves digestion	.445
	Immune booster	-.445
Packaging	Single bottle	-.380
	Packs of 5 bottles	.380
Purchase locations	Milk parlours	.136
	Supermarkets	.504
	Local shops	-.110
	Other retail stores	.530

Table 1. Selection of attributes and their levels of probiotic drink and dahi

Attributes	Probiotic Drink	Probiotic Dahi
Price and Quantity	₹10 – 65ml	₹26 -200g
Packaging and Labelling	Single bottle Pack of five bottles	
Health claims	Improves digestion Daily immune booster	Improves digestion Daily immune booster
Purchase Locations	Milk Parlours Supermarkets Local Shops Other Retail Shops	Milk Parlours Supermarkets Local shops Other retail shops

health claims.

Estimation of Willingness to Pay for Probiotic Drink

If the consumer wishes to double the quantity of the preferred combination by changing the quantity from 80 mlto 160 ml.

The change in utils quantity wise will be = 0.966-0.483=0.483

The change in utils with respect to price will be = 0.106-(-0.106) =0.212

The utility spread in the price range = 0.483/0.212=2.28

Willingness to pay for probiotic drink = Utility spread x Price difference between extreme prices.

WTP =2.28 × 12 = ₹27.36

So, the willingness to pay for the changed product attribute is found to be ₹27.36 in the case of probiotic drink.

Willingness to pay for Probiotic Dahi

For calculating the willingness to pay for probiotic dahi, the following model was considered (Table 5).

The utility index for different levels of the product attributes are presented in Table 6.

The study revealed that the Marginal WTP of the respondents for Probiotic Dahi is highest at a price of ₹25, for a quantity of 200 g when purchased from local shops and with a health claim of the immune booster.

The most important factors determining the consumers' willingness to pay are governed by the product's purchase location followed by prices (Figure 2).

Estimation of Willingness to Pay for Probiotic Dahi

If the consumer wishes to double the quantity of the preferred combination by changing the quantity to 400g from 200 g.

The change in utils quantity wise will be = 1.41 - 0.57=0.57

The change in utils with respect to price will be = 0.366 - 0.088=0.278

The utility spread in the price range = 0.57/0.278=2.05

Willingness to pay for probiotic drink = Utility spread x Price difference between extreme prices.

WTP =2.05 × 25 = ₹51.25

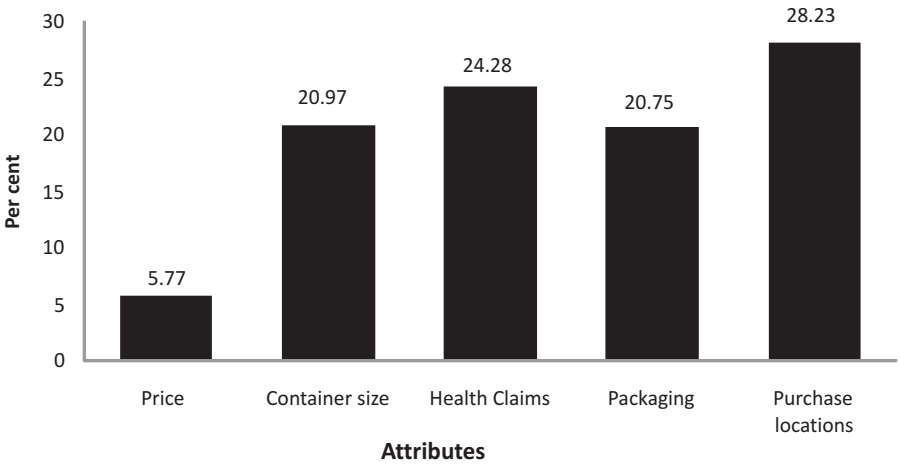


Figure 1. The relative importance of various attributes governing willingness to pay forprobiotic drink

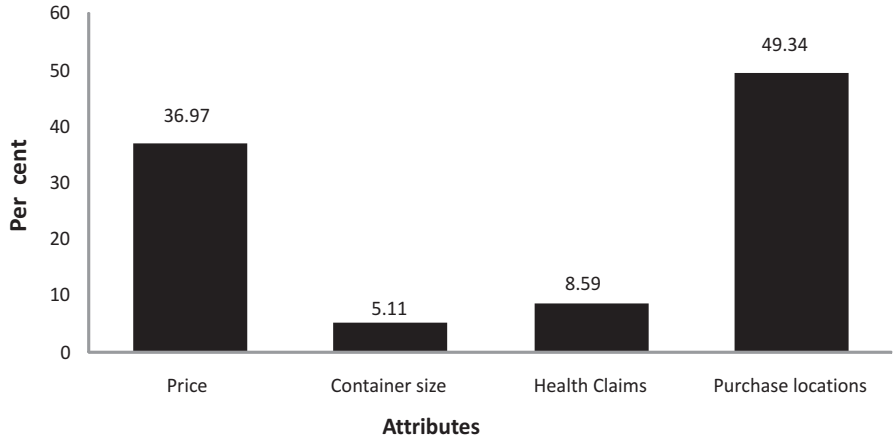


Figure 2. Relative importance of various attributes governing willingness to pay for probiotic dahi

Table 5. Model for determining willingness to pay for probiotic dahi

Attributes	Number of levels	Relation to ranks or scores
Price	3	Discrete
Container size	2	Discrete
Health claims	2	Discrete
Purchase locations	4	Discrete

Table 6. Utility index of various attributes of probiotic dahi

Attributes	Levels	Estimated utility
Price (`₹)	25	.366
	32	-.454
	50	.088
Container size (g)	200	.057
	400	-.057
Health claims	Improves digestion	-.095
	Immune booster	.095
Purchase locations	Milk parlours	-.205
	Supermarkets	.329
	Local shops	.485
	Other retail stores	-.609

So, the willingness to pay for the changed product attribute is found to be ₹51.25 in the case of probiotic dahi.

CONCLUSIONS

The varying food patterns, increase in per capita income, the rapid growth of middle-class population, increase in awareness among the Indian consumers provide varied opportunities for the probiotic companies to enhance their product penetration into the Indian market. The Indian Probiotic market is emerging as one of the highest growth potential markets worldwide due to multiple factors such as growing health concerns among consumers especially among the youth, changing food consumption patterns, increasing diabetic population, growing risk of stress/lifestyle related and cardiovascular diseases, and rising disposable income.The analysis by Tobit regression model indicates that the income, occupation and food habit of the respondents have significant effects on per capita monthly consumption of fermented probiotic dairy products. The fixed income earners (service holders) spent more on fermented probiotic dairy products than those of non-fixed income earners by₹ 34.39. The non-vegetarians spent fewer on the products than the vegetarians by ₹35.94. So, the fermented probiotic dairy products are a very good option to expand the Indian nutraceutical market and research related to that. The Marginal WTP of the respondents for Probiotic drink is highest at a price of ₹22, for a quantity of 80 ml when purchased from Supermarkets and with a health claim of improving digestion. The willingness to pay for the said combination of probiotic drink was found to be ₹27.36. The Marginal WTP of the respondents for Probiotic dahi is highest at a price of ₹25, for a quantity of 200 g when purchased from local shops and with a health claim of the immune booster. The WTP for probiotic dahi combination was found to be ₹51.25. Hence, the probiotic brands should focus on their distribution network so as to make the availability of the product convenient for the consumers because the willingness to pay off the consumer was highest for purchase locations.

REFERENCES

Carrillo, E., Prado-Gasco, V., Fiszman, S., & Varela, P. (2013). Why buying functional foods? Understanding spending behaviour through structural equation modelling. *Food Research International, 50(*1), 361-368.

Chase, D., Nilsson, T., Emunu, J.P., McCannHiltz, D., & Peng, Y. (2009). *Canadian consumer attitudes and purchasing behaviour of Omega-3 products.* Retrieved from http://www.consumerde mand.re.ualberta.ca/Publications/CMD percent 2007-04.pdf.

Govindrao, H.P. (2013). *A study on consumption pattern and consumer preferences for fermented functional dairy foods in metropolitan Maharashtra* (Master's Thesis). ICAR-National Dairy Research Institute, Karnal.

Lahteenmaki, L., & Urala, N. (2007). Attitudes behind consumers'willingness to use functional foods. *Food Quality and Preference, 15,* 793-803.

Yu, H.,& Bogue, J. (2013). Concept optimization of fermented functional cereal beverages. *British Food Journal, 115*(4), 541-563.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 252-255
DOI: 10.5958/2322-0430.2018.00066.5

NAAS Score: 4.82
www.naasindia.org
UGC Approved

An Economic Analysis of Marketing of Mustard in Fatehabad District of Haryana

Ravi Shankar Verma[1], and Rakesh Rathore[1]*

[1]*MBA (Agri Business) CCS, Haryana Agricultural University, Hisar, Haryana 125004*
[1*]*Ph.D. Scholar, Institute of Agri Business Management, Bikaner Rajasthan- 334006*

Corresponding author's email: rathorerakesh.iabm@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-134* *Revision Accepted: March 14, 2018*

ABSTRACT

The present study was undertaken in Fatehabad district of Haryana. Total sample size was 35 respondent wholesaler, retailer, and processor including 20 farmers. To study Marketing channel and price spread, cost, margin, and marketing efficiency of mustard is main objectives of the study. The village are randomly selected from the selected block under area of cultivation of the crop. Convenient sampling was adopted for conducting the study. The averages price at different points in the marketing channel are compare to get gross margin. Gross margin are deducted from marketing cost incurred by different intermediaries to get the net margin at different level. Marketing efficiency of Channel-I is 2.76 percent, Which is most efficient because of there is no marketing intermediary involved in this channel and marketing cost is very low in this channel and there is no marketing margin as there is no involvement of marketing intermediary, followed by Channel-II, in which marketing efficiency is 2.62 percent. There are mainly four marketing channel in the region for the marketing of mustard. In which, "Producer Wholesaler Retailer Consumer" channel is highly dominant through which high percent of the mustard product are traded. But in this channel, marketing efficiency is low due to number of intermediaries and high marketing cost and margin.

Keywords
Margin, marketing channel, mustard.

JEL Codes
C81, Q12.

INTRODUCTION

Oilseed crops play an important role in the development of agricultural economy. India accounts for 7.6 percent of world oilseeds output. India ranks third after China, and Canada in the world in the production of rapeseed and mustard.(Mustard crop Survey Report 2014-15) *Brassica juncea* (L.) is an Indian mustard which are important *rabi* season oilseed crop in India (Damodaran *et al*., 2005). Area (5.89 m. ha) and production (6.60 mt), meeting requirement of about 50percent population in the state of Uttar Pradesh, Punjab, Rajasthan, Madhya Pradesh, Bihar, Orissa, West Bengal and Assam. In India, mustard and rapeseed is the most important oilseed crop after groundnut accounting around 25 percent of total oilseed production (Kumrawat *et al*) Rapeseed and mustard is predominantly cultivated in the states of Rajasthan, Madhya Pradesh, Haryana, West Bengal, Uttar Pradesh, and Gujarat which contribute 86 percent area and 90 percent of total production (Nandal, 1986). In India, mustard seed is mainly grown in North-West parts of India. Rajasthan and Uttar Pradesh are the major producing states in the country. The production from Rajasthan is highly depend on monsoon. Madhya Pradesh, Haryana, Gujarat, West Bengal and Assam also good mustard producer state in India. In the year 2014-15 average yield1023 kg per hectare as against 1007 kg per hectare during the year 2013-14. It has increased by 1.5 percent as compared to previous year. Edible Oil production in India has increased at a CAGR of 2.6percent over past six years led by growth in Soybean Oil (3.4 percent) and rapeseed oil (3.8 percent).After Rajasthan and Uttar Pradesh, Haryana is the third major

mustard producing state in the country (Mustard Crop Survey Report, 2014-15).

The perusal of Table 2 show thatin Haryana, Bhiwani district take lead in growing mustard followed by Mahendragarh, Rewari, Hisar, Sirsa, Jhajjar, Mewat,and others.

RESEARCH METHODOLOGY

This chapter deals with the methodology adopted for undertaking the study. A brief description of the sampling design for the data collection and analytical procedure and techniques adopted for achieving result. The present study was conducted in Fatehabad district of Haryana. The village are randomly selected from the selected block under area of cultivation of the crop.

Method of Sampling

Convenient sampling was adopted for conducting the study. The study area was Fatehabad district, from which two block (Fatehabad block and Bhatukalan block) were selected.

Selection of Population

From these block, five village are selected. Two village Dhangar and Dharniya from Fatehabad block and three village Dhingsara, Kirdhan and Gadli from Bhatukalan block. Four farmer producer were conveniently selected from each village (20 farmers). Five respondent Wholesaler, processor, and Retailer (15) were also conveniently selected for information regarding marketing channel, cost, and margin of the mustard.

Data Collection Method

Primary Data

Primary data collected from 35 respondent (including 20 farmer) regarding cost and margin. The respondent Producer, wholesaler, and retailer were randomly selected.

Secondary Data

Secondary data collected from agricultural university, different websites, Extension Department and Krishi Vigyan Kendra Fatehabad regarding of mustard production in Fatehabad district of Haryana.

Table1. Estimated mustard production in Haryana during (2016-17)

District	Production 2015-16	Production 2016-17 (estimated)
Bhiwani	252.8	260.18
Mahendragarh	171	190
Rewari	161.7	188.65
Hisar	135.05	146
Sirsa	82.5	92.5
Jhajjar	74	74
Mewat	57.6	64
Other districts	136.5	140.4
State Total	**1071.15**	**1155.73**

Source: Department of Agriculture Haryana & estimated area of 2015-16 calculated on the basis of our survey.

DATA ANALYSIS

Marketing Cost and Marketing Margin

To calculate the marketing cost and margin in different marketing channel simple average and percentage method adopted or used. The averages price at different points in the marketing channel are compare to get gross margin. Gross margin are deducted from marketing cost incurred by different intermediaries to get the net margin at different level.

Marketing Efficiency

The movement of commodities from producer to consumer at lowest possible cost, consistent with provision of the services desired by the consumer, may be termed as an efficient marketing. An efficient marketing system is an effective system of change and important means of raising the income level efficiency of marketing. The formula suggested by Acharya and Aggarwal (1987).

$$M.E. = \frac{FP}{(MC + MM)}$$

Where, FP= Farmer price, MC= Marketing cost, and MM= Marketing margin.

RESULTS AND DISCUSSION

Marketing Channels of Mustard are identified as under:

Channel-I: Producer Consumer.

Channel-II:Producer Wholesaler Retailer Consumer.

Channel-III:Producer Wholesaler Miller/ Processor Retailer Consumer.

Channel-IV:Producer Miller/Processor Retailer Consumer.

Channel-I is shortest channel among all channel because no marketing intermediaries are involved in this channel. Channel-II involves producer, wholesaler, retailer and consumer, total price received by producer in this channel ₹32 per kg. The wholesaler sold the produce to retailer at the price ₹34.50 per kg with profit margin of ₹1.15 per kg, and retailer sold to consumer at the price ₹30.10 per kg. Channel-III is longest channel among all channel this channel include, producer, wholesaler, processor, retailer, and consumer. The producer sells to wholesaler at the price ₹32 per kg in this channel, retailer buy from wholesaler at the price ₹34.75 per kg with the profit margin of ₹1.30 per kg. The processor buys the produce from producer in this channel at the price ₹34.50 per kg and total cost incurred by processor in this channel₹37.60 per kg and sell to retailer at the ₹38.0 per kg. The price spread of Channel-IV, processed product purchase by retailer at the price ₹39 per kg, the retailer margin in this channel ₹3.10 per kg and finally product reach to the consumer at the price ₹43 per kg.

Marketing Efficiency

The perusal of Table 3 show that, Marketing efficiency of Channel-I is 2.76, Which is most efficient because of there is no marketing intermediary is involved

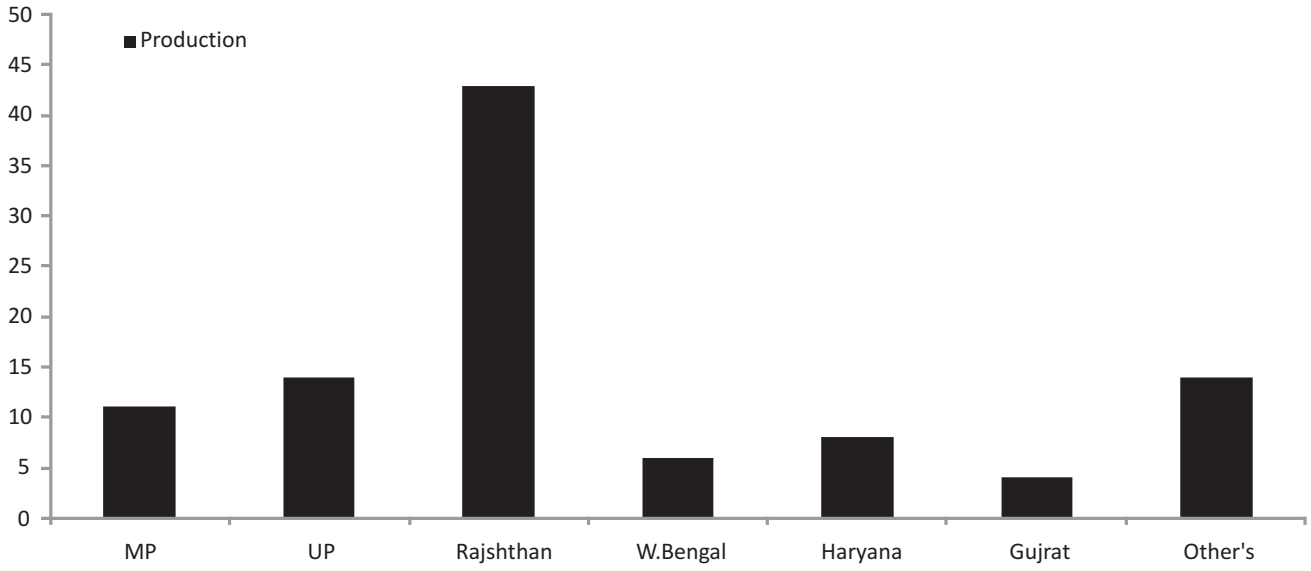
Table 2. Cost and Margin in marketing of mustard in selected area of Fatehabad district

(₹per kg)

Particular	Channel-I	Channel-II	Channel-III	Channel-IV
Producer				
Cost of production	8.5	8.5	8.5	8.5
Packing	0.30	0.30	0.30	0.30
Transportation, (loading and unloading)	0.75	0.75	0.75	0.75
Farmer total cost	**9.55**	**9.55**	**9.55**	**9.55**
Producer's price	36.00	32.00	32.00	36.00
Farmer margin	**26.45**	**22.45**	**22.45**	**26.45**
Wholesaler				
Purchasing price	0	32.00	32.00	0
Loading price	0	0.10	0.10	0
Losses	0	0.25	0.35	0
Miscellaneous charge	0	1.00	1.00	0
Total cost by wholesaler	**0**	**33.35**	**33.45**	**0**
Selling price to retailer	0	34.50	34.75	0
Wholesaler margin	0	1.15	1.30	0
Miller/ Processor				
Purchasing price	0	0	34.50	34.75
Loading/unloading	0	0	0.10	0.10
Labor charge	0	0	0.65	0.65
Processing cost	0	0	0.75	0.75
Packaging and labeling	0	0	0.35	0.35
Losses	0	0	0.50	0.50
Miscellaneous charge	0	0	0.75	0.75
Total cost	**0**	**0**	**37.60**	**37.85**
Selling price	0	0	38.50	39.00
Processor Margin	**0**	**0**	**0.90**	**1.15**
Retailer				
Purchase price of retailer	0	34.50	34.75	39.00
Transportation	0	0.25	0.25	0.25
Losses	0	0.30	0.30	0
Rent and miscellaneous	0	0.65	0.65	0.65
Cost by retailer	**0**	**35.70**	**35.95**	**39.90**
Selling price to consumer	0	38.10	38.50	43.00
Retailers Margin		**2.40**	**2.55**	**3.10**
Consumer				
Consumer purchase price	36.00	38.10	38.50	42.00

Table 3. Marketing efficiency of mustard marketing channel in Fatehabad District of Haryana

Channel	Farmer price (FP)	Marketing cost (MC)	Marketing margin (MM)	Marketing efficiency
I	26.45	9.55	-	2.76
II	22.45	2.55	6.10	2.62
III	22.45	5.10	6.50	1.93
IV	26.45	5.05	8.25	1.98



Source: Ministry of Agriculture, Government of India, New Delhi.

Figure. 1. Production of Mustard in India (2015-16)

in this channel and marketing cost is very low in this channel and there is no marketing margin as there is no involvement of marketing intermediary, followed by Channel-II, in which marketing efficiency is 2.62. However, marketing cost and marketing margin is less than other marketing channel except Channel-I.

CONCLUSIONS

There are mainly four marketing channel in the region for the marketing of mustard. In which, "ProducerWholesaler Retailer Consumer" channel is highly dominant through which high percent of the mustard product are traded. But in this channel, marketing efficiency is low due to number of intermediaries and high marketing cost and margin. Marketing efficiency of Channel-I is 2.76 percent, Which is most efficient because of there is no marketing intermediary is involved in this channel and marketing cost is very low in this channel and there is no marketing margin as there is no involvement of marketing intermediary, followed by Channel-II, in which marketing efficiency is 2.62 percent. However, marketing cost and marketing margin is less than other marketing channel except Channel-I. This efficiency is attained by low number of intermediaries and also the value addition in the product with less cost and margin. Marketing efficiency of Channel-III is 1.93 percent and involvement market intermediaries are higher in this channel. Marketing efficiency of Channel-IV is 1.98 percent, which is higher than channel III, because of involvement of a number of marketing intermediaries which increase marketing cost and marketing margin.

REFERENCES

Acharya, S.S., & Agarwal, N.L. (1987). *Agricultural marketing in India*. New Delhi: Oxford &. IBH Publishing Company.

Damodaran, T., & Hegde, D.M. (2005). *Oilseeds situation: A statistical compendium 2005*. Directorate Oilseeds Research, Indian Council of Agricultural Research, Hyderabad.

Nandal, D.S. (1986). Marketing of rapeseed and mustard in Hisar district of Haryana state. *Indian Journal of Agricultural Marketing, 13*(1), 44.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 256-259
DOI: 10.5958/2322-0430.2018.00067.7

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Modeling of Sugar Prices Volatility in India using Autoregressive Conditional Heteroskedasticity Models

Pooja Gamit[1], Alpesh Leua[2] and Vishal Tandel[1]*

[1]*PG Scholars, N. M Collage of Agriculture,* [2]*Associate Professor, AABMI, NAU, Navsari*

[*]*Corresponding author's email: gamitpoojav@gmail.com*

Received: January 14, 2018 *Manuscript Number: NS-18-88* *Revision Accepted: February 19, 2018*

ABSTRACT

This paper attempts to model and forecast the sugar prices volatility in the India using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models. Various types of GARCH models for instance; GARCH (1,1), EGARCH(1,1)were applied to sugar the period 1995 - 2015; to test the hypothesis of persistence, asymmetry and volatility of the spot and futuresprices. It is found that, the sum of ARCH and GARCH coefficients is not close to one,indicating that volatility shocks is not quite persistent, moreover volatility, in addition none of sugar spot and futures prices has an impact of bad news on the price volatility, while lastly leverage effect is not present on the conditional variance. Therefore (GARCH) models are appropriate in modeling and forecasting sugar prices volatility.

Keywords

ARCH, asymmetry, EGARCH, heteroskedasticity, leverage effect, price volatility, sugar, volatility clustering.

JEL Codes

C22, E 37, O13, P22, Q11, Q18.

INTRODUCTION

India has been known as the original home of sugarcane and sugar. Sugar is one of the most important commodities; produced and consumed around the world. India is the second largest producer of sugar in the world having a share of over 17 percent of world's sugar production after Brazil's 22 percent. In India, two grades of sugar namely S-30 and M-30 are produced where grade S-30 dominating the share in total production. (Deokate, 2013) and produces more of cane sugar and not beet sugar. It produces approximately 22 million tonnes of sugar annually, with Maharashtra contributing over one-third of it. The sugar Industry in India is the 2nd most important agro-processing industry after textiles. Total 704 sugar mills in India. It holds great significance in the country's economy. India has a significant share in world sugar economy. India is the largest consumer of the sugar and about 62-65 percent of sugar is consumed directly by bulk users. India was sixth largest exporter of sugar in 2014-15 having a share of 2.76 percent in the total global export. The government is working on a new subsidies scheme which is to be implemented in the current year 2015-16 (News on the Indian Sugar Industry, 2015).

Importance of Sugarcane and Sugar

Sugarcane is a most important cash crop of India. It involves less risk and farmers are assured up to some extent about return even in adverse condition. In agriculture sector, sugarcane shared percent of the total value of agriculture output and occupied 2.3 percent of India's gross cropped area during 2014-15. Sugarcane provides raw material for the second largest agro-based industry after textile. About 527 working sugar factories were located in the country with total crushing capacity of about 242 lakh tonnes.

The sugar industry is an instrumental in generating the sizeable employment in the rural sector directly and through its ancillary units. It is estimated that about 50 million farmers and their dependents are engaged in the cultivation of sugarcane and about 0.5 million skilled and unskilled workers are engaged in sugar factories and its allied industries. The sugar industry in India has been a focal point for socio-economic development in the rural

areas by mobilizing rural resources, generating employment and enhancing farm income. Some of sugar factories have also diversified into by-products basis industries and have invested and put up distilleries, organic chemical plants, paper, ice board factories and co-generation plant.

METHODOLOGY

Time series data on the monthly wholesale price index (WPI) from year1995-2005 data on monthly WPI of base series a 1994-95 and 2005 -2015 data on monthly WPI of base series 2005-06 were taken from 1995-2015 of sugar was obtained from the data published by the office of Economics Advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

The growth rates in wholesale price indicate were estimated for two different periods, which are pre futures market period (1995-2005) and post futures market period (2005-2015) for a better understanding of the role of futures trading in changing price scenario. For the study of volatility and find relationship between spot and futures price of sugar was study as per the availability of data for the following periods.

Period	Name of Period	Period of study
I	Pre-futures Market	1995-2005
II	Post-futures Market	2005-2015

The monthly spot and futures prices of sugar obtained from the websites of National Commodity and Derivatives Exchange Limited (NCDEX) (http: //www.ncdex.Com/market), Mumbai July, 2005 to December, 2015 (for a period of 10 years). The sample period was used in analysis was based on availability of data and by smoothing of data after adjusting holidays and non-trading days.

Volatility in Spot and Futures Prices of Sugar

Generally, volatility refers to the fluctuation in prices of commodities/goods. In agricultural commodities, volatility originates mainly from supply disturbances. These disturbances coupled with short-run demand and supply elasticities give rise to acute price fluctuations. A price series can be highly volatile yet change over longer period of time; or show little volatility but a considerably large change over time through discrete adjustments. It can be measured using the univariate ARCH-type models for spot and futures prices of sugar.

The literature on volatility spill over indicates that the study of volatility spill over can be of two types. The first one was the study of volatility spill over on return series, or errors from modelling return series and how return is related within market. The second one is directly to examine volatility, that is, price volatility. This study used the second method that means it examined directly the volatility spill over between futures and spot market for sugar. The results of volatility analysis using the univariate GARCH-type model for the sugar were given in Table.

Garch, Egarch Model Specification

GARCH, EGARCH model for measuring volatility in spot and futures prices

Volatility was measured using the GARCH and EGARCH models through Eviews software. The univariate GARCH (1, 1), EGARCH (2, 1), models for both the mean and the variance equation for spot price and future prices of sugar under examination are estimated using the maximum likelihood estimation method. Autoregressive Conditional Heteroskedasticity (ARCH) models are specifically designed to model and forecast conditional variances. The variance of the dependent variable is modelled as a function of past values of the dependent variable and independent or exogenous variables.

ARCH models were introduced by Engle (1982) and generalized as GARCH (Generalized ARCH) by Bollerslev (1986).These models are widely used in various branches of econometrics, especially in financial time series analysis.

The ARCH specification:

In developing an ARCH model, one has to provide two distinct specifications - one for the conditional mean and one for the conditional variance. In this study; the GARCH (1, 1) model was used, which is as follows. In the standard GARCH (1, 1) specification:

$Z_t = \gamma_0 + \gamma_1 X_{1t} + \gamma_k X_{kt+t}$ .....(1)

$\sigma_{t2} = \omega + \alpha\, e_{2t-1} + \beta\sigma_{2t-1}$..... (2)

The mean equation given in equation (1) is written as a function of exogenous variables with an error term. Here dependent variable is spot or futures price i.e. Z_t and X_{kt} exogenous variable.

Since σ_{t2} is the one-period ahead forecast variance based on past information, it is called conditional variance. The conditional variance equation specified in (2) is a function of three terms:

1. The mean: ω
2. News about volatility from the previous period, measured as the lag of the squared residual from the mean equation: e_{2t-1} (the ARCH term)
3. Last period's forecast variance: σ_{2t-1} (the GARCH term)

The (1, 1) in GARCH refers to the presence of a first-order GARCH term (the first term in parentheses) and a first-order ARCH term (the second term in parentheses). An ordinary ARCH model is a special case of a GARCH specification in which there are no lagged forecast variances in the conditional variance equation.

In GARCH model the conditional variance of return series is expressed as a function of constant, past news about volatility $^2_{t\ i}$ terms and past forecast variance (h^2_{t-i}) terms. In the GARCH (p,q) the conditional variance is expressed as follows:

$$_t \qquad _t\sqrt{h_t}$$

$$h_t^2 \quad \sum_{i\ 1}^{p} \quad {}_{i\ t\ i}^{2} \quad \sum_{j\ 1}^{q} \quad {}_{j} h_{t\ j}^{2}$$

Where $_t$ is independently identically distributed random variable with mean zero and variance,

$$0, \quad {}_{j\ 0} \ \ and \ \sum_{i\ 1}^{\max(p,q)} \ (\ {}_{i} \ \ {}_{j}) \ \ 1$$

In the EGARCH models, the effect of recent residuals is exponential rather than quadratic. The variance equation of this model can be expressed as follows

$$Log(h_t^2) \qquad 1 \left| \frac{t}{\sqrt{h_{t\ i}^2}} \right| \quad 2 \frac{t\ 1}{h_{t\ 1}^2} \qquad \log(h_{t\ 1}^2)$$

Asymmetry is a chivvied when $_2$ 0.The impact of good news such as new market infrastructure is captured by

$$\frac{1 \quad 2}{\sqrt{h_{t\ 1}^2}}$$

(while the impact of bad news such as political stabilities or unfavourable weather is expressed by

$$\frac{1 \quad 2}{\sqrt{h_{t\ 1}^2}}$$

A negative and significant $_2$ is an evidence of asymmetry and greater impact of negative shocks on price volatility.

RESULTS AND DISCUSSION

Auto Regressive Conditional Heteroscedasticity (ARCH) with Spot Price and Futures Price for Sugar

The univariate GARCH (1, 1), EGARCH (2, 1), models for both the mean and the variance equation for spot price of sugar under examination are estimated using the maximum likelihood estimation method. Below were the reports parameter estimates of each model.

Estimated Parameters of GARCH (1, 1) Models for Sugar Spot and Futures Price

The GARCH (1, 1) model for sugar spot prices and futures price series can be written into conditional mean and conditional variance equations as below:-

Table 1 and 2 reports the parameter estimates, AIC and SC criteria of conditional volatility GARCH (1, 1) model for sugar spot prices and Futures prices under consideration. For the sugar spot prices and futures prices returns series and the sum of ARCH and GARCH coefficients was not close to one in sugar indicating that volatility shocks was not quite persistent, the coefficient of lagged squared price was positive and statistically significant for sugar, indicating that strong ARCH effects were apparent for sugar. Also the coefficient of lagged conditional variance was significantly negative and less than one indicating that the impact of old news on volatility is not significant.

The estimation parameters of the EGARCH (2, 1) model for sugar spot price and futures price series, the estimation results shows that; the estimates ϒ was negative and statistically significant, meaning that spot price and futures price had and greater impact of negative shocks on the price volatility. Moreover, the estimates β = 0.241 for spot and for futures β = - 0.331 is statistically significantly at 5% significant level which was an indication of persistence of volatility.

The perusal of Table1 shows the parameter estimates, AIC and SC criteria of conditional volatility EGARCH (1, 1) model for sugar spot prices and futures price under the analysis. For the sugar futures prices and spot price series, EGARCH (1,1) shows that the parameter ϒwas negative and statistically significant meaning that the series had asymmetry and greater impact of negative shocks on the price volatility. Further-more, EGARCH (1,1) model shows that the parameter was negative and statistically

Table 1. Estimated parameters of GARCH (1, 1) models for sugar spot& futuresprices.

(R_t = 0.00133 + ₹$_t$, σ^2_t = 0.00027 + -0.0144 ₹$^2_{t-1}$ +-0.226σ^2)

Commodity (Sugar)	μ	□	α	β	α+β	AIC	SC
Spot price	0.0013	0.00027	-0.014	0.226	0.211	-5.014	-4.94
Futures price	0.0044	0.000612	0.352	-0.0072	0.344	-4.066	-3.95

(R_t=0.0044 + ₹$_t$, σ^2_t=0.000612 + 0.352 ₹^2_t, Estimated parameters of EGARCH (2, 1) models for sugar spot and futures prices).

Table 2. Estimated parameters of EGARCH (2, 1) models for sugar spot and futures prices

(R_t = -0.00148 + ₹^2_t, Log σ^2_t = 0.00186 + 0.1077 | ₹$_{t-1}$/ σt_{-1}| - (-0.0296) ₹$_{t-1}$/ σt_{-1}- 0.241 log σ^2_{t-1})

Commodity	μ	□	α	β	□	α+β	AIC	SC
Spot price	-0.0014	0.00186	0.1077	0.241	-0.029	0.348	-3.878	-3.791
Futures price	0.0028	0.000521	0.153	-0.331	-0.059	-0.178	-4.074	-3.943

(R_t = 0.00289 + ₹^2_t, Log σ^2_t = 0.000521 + 0.153 | ₹$_{t-1}$/ σt_{-1}| - 0.059 ₹$_{t-1}$/ σt_{-1}-0.331 log σ^2_{t-1})

significant for sugar, which was an indication of persistence of volatility on the conditional variance.

CONCLUSIONS

Sugar prices forecasting becomes an important issue in forecasting in the markets. Sugar generally tends to be varying over time, the causes of such behavior in the price series may range from: speculation, unfavorable weather conditions, unfeasible traditional, risk management, policies and finally the lack of capacity of the farmers to discover trends in price series. In addition, major farmers identified the prices fluctuation (volatility) due to changes in agricultural production and trade related to physical attributes of the production, changes in macroeconomic environment and their impacts influencing both supply and demand sides, and agricultural and trade policies and various policy responses influencing in the primary commodities.

Price variability is a component of market risk for both producers and consumers, it is necessary to develops and build a forecasting models to represent it. Forecasting of sugar prices volatility has been an important area of inquiry and research in financial time series for the recognition to the time-varying (volatility, persistence and changes in volatility, volatility clustering, leverage effect and asymmetry in volatility) in the prices movements. Thus it is important to understand the pattern of sugar prices volatility in Sudan (Musa, 2010). This paper employs ARCH/GARCH models to obtain parsimonious and appropriate models used in modelling and forecasting sugar prices data in the India. The purpose of this paper is to evaluate an appropriate model and investigating its ability to forecast and capture common facts about conditional volatility, such as persistence, change in volatility, asymmetry and leverage effects on sugar prices data in the India.

Autoregressive Conditional Heteroskedasticity (GARCH) models were applied to sugar prices data. GARCH (1,1), EGARCH(1,1), and TGARCH(1,1) models were applied to sugar to handle prices volatility, The above findings confirm the following results;

I. The application of GARCH (1,1), EGARCH(1,1), models on sugar was shown that:

ii. For GARCH (1,1) models, the estimated coefficients are statistically significant for sugar, the sum of ARCH and GARCH coefficients is not close to one for sugar spot and futures prices indicating that volatility shocks is not quite persistent.

iii. For EGARCH (1,1) models, the parameter was negative and statistically significant meaning that the series had asymmetry and greater impact of negative shocks on the price volatility. This was an indication of persistence of volatility on the conditional variance.

REFERENCES

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity, *Journal of Econometrics*, *31*(3): 307-327.

Deokate, T.B. (2013). *India's sugar trade: A fresh look*. Mumbai: Indira Gandhi Institute of Development Research (pp. 1-45). Retrieved from http://www.igidr.ac.in/pdf/publication/ WP-2013-024.pdf.

Engle, R. (1982). Autoregressive conditional heteroskedasticity with estimates of United Kingdom inflation, *Econometrica, 50*(4), 987-1008.

Musa, A.G.M. (2010). *Modeling agricultural commodity prices volatility in Sudan using autoregressive conditional heteroskedasticity models*. Alneelain University-Khartoum-Sudan School of Statistics and Actuarial Science, pp:1-14. Retrieved from http://neelain.edu.sd/mmacpanel/includes/magazines/pdf/3_25_14.pdf

News on the Indian Sugar Industry. (2015, October, 19). Government taking initiative to set sugar industry back on growth trajectory. *Sugar Industry News.* Retrieved from http://sugarnews.in/government-taking-initiative-to-set-sugar-industry-back-on-growth-trajectory/

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 260-263
DOI: 10.5958/2322-0430.2018.00068.9

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Economic Analysis of Natural Amla Candy Processing, Enhancing Farmer Income

Gunish Rai, Rahul Gupta and Karanvir Gill*

Department of Food Science and Technology, Punjab Agricultural University, Ludhiana-141004

**Corresponding author's email: gunishrai18@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-17* *Revision Accepted: March 10, 2018*

ABSTRACT

Fruits are important supplement of the human diet as they possess almost all nutritive components required for the growth and development of the human body. Indian gooseberry or amla is very rich source of Vitamin C. It is a rich source of calcium, phosphorus, iron, carotene, and Vitamin B complex. The present research work was undertaken to prepare amla candy and to study the economic feasibility of candy processing, to calculate the cost of prepared product and to analyze the potential of profit-making from amla candy for the farmers.

Keywords
Amla, candy, economic feasibility, farmers, processing, profit.

JEL Codes
D24, L66, O10.

INTRODUCTION

Aonla or Amla (*Emblica officinalis*) belongs to the family *Euphorbiaceae*, popularly known as Indian gooseberry, is major constituent in several Ayurvedic preparations like Chyavanprash, which enhances health and longer life (Singh & Pathak, 1986). Amla is a rich source of fiber which helps in regulating the bowel action, has anti-diabetic quality, protects gallbladder from infections, cures scurvy and protects against pollution and also used in therapies of diarrhea, jaundice, inflammation and a number of other illnesses (Kumar *et al.*, 2012). However, little was known about the chemistry and biological activity of its major constituents, the hydrolyzable tannins, except that they contained gallic and ellagic acids, inhibited the degradation of Vitamin C and had some pharmacological activity entirely unrelated to the clinical use of the fruits (Ghosal *et al.,* 1996). In this ancient medicine, the fruit is processed according to a method named "Svaras Bhavana", whereby the therapeutic potential of the plant is enhanced by treating the main herb with its own juice (Scartezzini *et al.,* 2006). Amla has approximately 20 times more Vitamin C content than orange. "Amla" is an anti-oxidant, which prevents premature aging, provides strength to lungs, acts as a coolant and also helps in maintaining body weight due to its richness in nutrients. It provides 58 calories, 13.7 gm carbohydrates, 50 gm calcium, 20 mg phosphorus, 1.2 mg iron, 0.03 mg thiamine, 0.01 mg riboflavin, 0.2 mg niacin, 600 mg Vitamin C, 5.0 mg sodium, 225 mg potassium (Asmawi, 2009). Alma also contains leucoanthocyanidin which prevents the oxidation of Vitamin C (Vikram *et al.*, 2014).

Preservation is a process by which certain foods like fruits and vegetables are prevented from getting spoiled for a long period of time. The color, taste and nutritive value of the food are also preserved. Amla candy is the preserved form of raw amla. The need of preservation is felt when raw fruit is available in abundance. Preserved food is easier to distribute and is readily available throughout the year. Amla candy is another form of amlamurabba (Amla Preserve). Children who do not like to eat amlamurabba eat amla candy happily. Among the unique products of amla, the candy has much demand in domestic as well as export point of view. To strengthen

market, storability and superior quality of amla candy is of prime importance. Candies are becoming more and more popular because of high acceptability, minimum volume, higher nutritional value and longer storage life.

Amla is a very adaptive type of plant. A fully mature plant can tolerate freezing temperature as well as high temperature up to 46°C. Amla thrives well in light, medium heavy soils and alkaline soils and is well adapted to dry regions (Goyal *et al.*, 2008). Number of seedlings of amla per acre are 200 whereas per hectare these can be 500 in number. Intercrops like black gram, green gram, cowpea, horse gram can be grown which brings about extra profit.

Punjab is a state of very high fertile soil and thus there are lots of alternatives for farmers in case of selection of crops. Amla is an industrial crop so; farmers in Punjab look for other alternatives in respect to earn more profit.

In district wise production data (2004-05) of various fruits in Punjab, Amla was not even included due to very less area under amla cultivation. In data of 2007-08 amla fruit is included where total area under Amla cultivation was recorded 188 hectares with production of 2280 M. tonnes in Punjab. In recent data (2014-15) of Punjab, horticulture total area under cultivation of amla in Punjab has soared to 442 Hectares with a total production of 6059 M. tonnes. Hoshiarpur district has the highest area under amla cultivation (223 ha).

Flowchart of Amla Candy Preparation

(Mishra *et al.*, 2011)

Fresh Amla fruits
↓
Washing
↓
Boiling
↓
Sorting and segmenting
↓
Sugar syrup boiling and strengthening
(Daily basis to reach TSS 70ºbrix)
↓
Dipping in amla syrup
(Daily after boiling)
↓
Addition of citric acid
↓
Separation of amla candy from syrup
↓
Drying of Candy
(50°C in dryer or sun drying)
↓
Sugar Coating
(Powdered sugar)
↓
Packing
↓
Storage

MATERIAL AND METHODOLOGY

Material

Chakaiya variety was used for preparation of amla candy was procured from local market. Sugar and citric acid requirement is approximately 1.5 times the raw amla sample.

Method

Raw Amla were boiled in water for 7 minutes and then immediately transferred to cold water to prevent its further cooking. Afterwards, the segmentation of each Amla was done into 6 pieces. Sugar syrup of 30°Brix was prepared and the Amla segments were dipped overnight into it. Next day the Amla segments were taken out of syrup. Syrup was then boiled and addition of sugar was done to take its concentration up to 40°Brix and was again kept overnight with dipped amla segments. This procedure was followed until the sugar syrup reaches concentration of 70°Brix. Citric acid was then added to sugar syrup to form invert sugar so that the sugar does not crystallize during the process of drying. Further, the segments were dried in tray dryers for 8-20 hours at 50°C and were coated with powdered sugar before packing.

PROFIT POTENTIAL FOR FARMERS

Hoshiarpur is having the maximum area under amla cultivation in Punjab because numerous amla processing industries are operating in that region through which the cultivators can get value for money for their produce. But in other regions of Punjab where farmers have other beneficial crop alternatives or there is problem of transportation due to remote processing industries of amla, how could farmers get motivated to produce amla? This motivation can be created by profit analysis which farmers could attain by capitalizing their existing labor and some one time investments. Farmers doing intercropping of amla with other crops or amla producers

Table 1. Seasonal yield of amla and comarison of raw amla selling and selling it by converting it in candy form

Seasonal yield (single mature tree)	No. of seedlings (per acre)	Total produce (approx..)	Market rate of raw Amla (₹12/kg) =12,000*12	Amla candy production (from total produce)	Market rate of Amla candy (180 ₹/kg) =7,800*180
50-70 kg	200	12,000 kg	₹1,40,000	7,800 kg	₹1,404,000

Source: http://www.agrifarming.in/amla-farming/ and market survey of Amla candies.

in remote areas from processing industry could increase their earning by processing on their own because processing of amla is not very sophisticated type of processing. It just needs general guidelines, labor,and equipments.

As per data and experiences, it is estimated that approximately 7800 kg of Amla Candy can be obtained from 120, 00 kg Raw Amla (Maurya *et al.,* 1995). Sun-dried candy is comparatively cheaper as compared to candy dried in dryers. Sun-dried candies usually range from ₹150-₹180 per kg whereas candies dried in dryers range from ₹200-₹380 kg.

RECURRING EXPENSES/ SEASON

1. Raw Amla = ₹1,40,000
2. Sugar (granular + Powdered) = ₹5,50,000
3. Citric acid = ₹500
4. Fuel = ₹20,000
5. Utensils = ₹10,000
6. Packaging material = ₹10,000
7. Transport = ₹10,000

WAGES / SEASON

Labour (5) = ₹25,000

Table 2. Basic requirements of equipments for small-scale Amla candy processing at farmer's level

Equipments	Price (₹)
Dryer	1,50,000
Burner	20,000
Refractometer (3 ranges)	15,000
Sealer	2000
Total	**1,87,000**

Source: http://www.industrybuying.com/

Table 3. Potential returns from the project of processing amla candy at farmer's level with the help of some basic equipments and farm labour

	(₹)
Material to be processed / season (kg)	12,000
Total Processed Amla Candy/ season (kg)	7,800
Gross Return (Market value of Amla Candy; 7800*180)	1,404,000
Recurring costs	7,65,500
Return over variable cost (Gross return - Recurring costs)	6,38,500
Amount of interest on total Investment (10% of ₹9,52,500)	95,250
Amount of depreciation on fixed capital @ 5% (5% of ₹1,87,000)	9350
Net margin / season (Return over variable cost - interest on investment - depreciation)	5,33,900

Source: Changule et al. (2010).

Recurring expenses/ Season (A+B) = ₹7,65,500.00

Total Investment=₹7,65,500 + ₹1,87,000= ₹9,52,500.00

If the farmer wants to sell his produce then he may just get ₹1, 40,000 at the rate of ₹12 per kg. Value addition of amla could be more beneficial as compared to selling amla in its raw form. Therefore, if batches are processed and enough space is available for sun drying an immense profit can be attained by a farmer. An amla grower may earn about ₹1,40,000 by selling his raw 12,000 kg Amla but if the process it into amla candy then he can earn about ₹1,404,000 for the same. So, there may be a profit of ₹5, 33,950 for the same raw material. According to a case study by (Gajanana *et al.,* 2008), an excellent quality of taste and nearness to home can potentially contribute to the successful marketing of amla candy. Farmer can gain some more benefits from its processing by-products (like amla syrup) depending upon type of market available nearby.

CONCLUSIONS

From above calculations and estimations, it can be concluded that amla which is considered an industrial crop can also help the farmer in boosting his seasonal income by some one-time investments. The on-farm processing is economically feasible because raw material can be taken from farm itself, previously hired farm labor can be used, farm waste could be utilized as fuel for ignition of stove and on-farm sun drying is also very easy. So, in a nutshell, amla farming can be very lucrative for a farmer if an authentic way of Amla farming and processing is provided to him.

REFERENCES

Asmawi (2009), Anti-inflammatory activities of *Emblica offcinalis*. *Journal of Pharmacy and Pharmacology. 45*(6), 581-584.

Changule, R.B., Pawar, B.R., & Shelke, R.D. (2010). Economics of aonla processing business unit in Maharashtra.*International Journal of Commerce and Business Management 3*(1), 6-9.

Gajanana, T., Gowda, I.N.D., & Reddy, B.M.C. (2008, September 4). New crops and uses–Their role in a rapidly changing world. Paper presented in *5th International Symposium* held at University of Southampton, Southampton,UK.

Ghosal, S., Tripathi, V.K., & Chauhan, S. (1996). Active constituents of *Emblica officinalis*: Part 1-The chemistry and anti-oxidative effects of two new hydrolyzable tannins, Emblicanin A and B. *Indian Journal of Chemistry, 35B*(9), 941-948.

Goyal, R.K., Patil, R.T., Kingsly, A.R.P., Walia, H., & Kumar, P. (2008). Status of post-harvest technology of aonla in India-A review. *American Journal of Food Technology, 3*(1), 13-23.

Kumar, K.P.S., Bhowmik, D., Dutta, A.Akhilesh, Yadav, P.D., Paswan, S., Srivastava, S., & Deb, L. (2012). Recent trends in potential traditional Indian herbs *Emblica officinalis* and its medicinal importance. *Journal of Pharmacognosy and Phytochemistry, 1*(1), 24-25. Retrieved from http://www.phytojournal.com

Maurya, O.P., Singh, G.N., & Kushwaha, R.K.S. (1995).

Economics of production and processing of aonla in district Varanasi,U.P.: A case study. *The Bihar Journal of Agricultural Marketing, 3*(2), 145-151.

Mishra, S., Verma, A., Prasad, V.M., & Sheikh, S. (2011). Development of value-added amla candy with rose extract. *The Allahabad Farmer Journal*, *66*(2), 134-136.

Scartezzini, P., Antognoni, F., Raggi, M.A., Poli, F., & Sabbioni, C. (2006). Vitamin C content and antioxidant activity of the fruit and of the Ayurvedic preparation of *Emblica officinalis* Gaertn. *Journal of Ethnopharmacology*, *104*(1), 113-118.

Singh, I. S., & Pathak, R.K. (1986). Evaluation of aonla (*Emblica officinalis* Gaertn) varieties for processing. Paper presented in *VIth International Symposium on Medicinal and Aromatic Plants, XXII IHC 208*. Retrieved from https://www.ijcmas.com.

Vikram, B., Prasad, V. M., & Saroj, P. L. (2014). Comparative study of varieties, honey coating and storage durations on Aonla candy. *Indian Journal of Horticulture*, *71*(1), 104-108.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 264-271
DOI: 10.5958/2322-0430.2018.00069.0

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Extent of Credit Availed by Rural Households in Punjab: Purpose-wise and Source-wise Analysis

Lovepreet Singh and Arjinder Kaur*

Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141 004

**Corresponding author's email: lovelydiwan@gmail.com*

Received: October 31, 2017 *Manuscript Number: NS-18-08* *Revision Accepted: February 28, 2018*

ABSTRACT

The present study has been undertaken in three agro-economic zones of Punjab to examine the extent of credit availed by rural households in Punjab. Multistage random sampling technique was used for the selection of 90 farmers. A typical feature of the Indian rural credit market has been the coexistence of institutional and non-institutional sources of finance.Accordingly farmers were found to be borrowing from both the sources for their short-term as well as long-term credit needs. It was found that sampled farmers were borrowing more from institutional sources and commercial banks were their main suppliers of credit. In long-term, farmers were borrowing for both productive as well as unproductive purposes. None of the institutional source was directly providing credit for unproductive purposes; it was the diversion of institutional credit for unproductive purposes. It was observed that for productive purposes higher amount of credit was borrowed from institutional sources, while for unproductive purposes borrowing from non-institutional sources was found to be higher.

Keywords
Agriculture credit, Punjab, purpose, source.

JEL Codes
Q12, Q13, Q14.

INTRODUCTION

Capital is the most crucial input in any industry and agriculture is no exception to it. Capital accumulation is of prime importance for any model of growth and development and it depends on the rate of investment (Sidhu & Gill 2006). Punjab agriculture has witnessed transformation from traditional towards commercialization, under green revolution during mid1960's. Due to commercialization, agriculture became capital intensive. So, the demand for credit has increased manifold for adoption of new technology (Toor *et al*., 2016). Agricultural credit has played a vital role in supporting farm production, as it makes possible to take shortcut by enabling to take advantage of new technologies to expand the farming business and to operate it on the profitable basis (Kumar *et al*., 2010). So, the credit has become a catalytic agent in upgrading the agriculture from subsistence to modern level. As we know income from the agriculture is not regular due to its seasonal nature. So farmers have to borrow to fulfill their farm and consumption needs. Due to reasons like small size of operational holding, increasing cost and shrinking profit margins, uncertainty and risk in agriculture, credit becomes the important component of agriculture enterprise.

A typical feature of the Indian rural credit market like other developing economies is the coexistence of institutional and non-institutional sources of finance (Choubey & Singh, 2003). The farmers need credit both for the productive as well as unproductive purposes and in this respect, they approach both institutional and non-institutional sources of credit. The non-institutional finance sector was characterized by highly personalized transaction, entailing flexibility in respect of loan amount, purpose, interest rate, collateral requirement, maturity period etc. and they provide credit for both productive and unproductive purposes. On the other hand, there was the institutional sector where the scale of operation was much larger and loan terms were standardized and they provide credit only for productive purposes (Gill, 2004).

Basically, the terms and conditions of institutional sources were fixed and uniform for all, but it was varying from person to person in case of non-institutional sources of credit. So in this regard, the present study has been devised to find out the purpose wise and source wise credit availed by rural households in Punjab.

METHODOLOGY

The present study was conducted in all the three agro-economic zones of the state during the year of 2015-16. Multistage random sampling technique was used to select the respondent farmers. At first stage, one district was selected randomly from the each zone. Shaheed Bhagat Singh Nagar (erstwhile Nawanshahr) was selected from the Zone-I (Sub-mountainous zone), Barnala was selected from the Zone-II which is the Central plain zone and Bathinda was selected from the Zone-III (South-western zone) of the state. At the second stage of sampling, one block was selected from the selected district. At next stage, two villages were selected from each selected block. At the last stage, fifteen farmers were selected from each village falling under three categories based on the size of operational holding defining small (up to 5 acres), medium (>5 acres up to 25 acres) and large (>25 acres) farmers. Thus, a sample of 90 farmers covering six villages, three blocks and three districts of Punjab was finally chosen for the ultimate analysis.

Simple statistical techniques like percentages and averages were used in order to study the extent and purpose wise credit availed for short term and long-term purposes. Garret's Ranking Technique has been used to rank the reasons given by the sampled farmers for the preference in favor of institutional and non-institutional sources of credit.

RESULTS AND DISCUSSION

Socio-economic Profile of Sampled Farm Households

Socio-economic profile of the sampled households clearly brought out that majority of respondent farmers (56.67 percent) belonged to 40 years of age, while 54.44 percent were having a family size up to 5 members. On overall basis, average size of operational holding of the sampled farmers was worked out to be 11.56 acres. Out of this owned area was 9.8 acres, leased in was 2.38 acres while leased out was only 0.62 acres. It was found that majority of sampled farmers' belonged to general category. On overall basis, out of the total labour employed by sampled farmers, 21.77 percent was constituted by family labour, 7.14 percent by permanent labour and 71.09 percent by the casual labour. The extent of average annual net income earned by the sampled households from all sources came out to be ₹376354 per household. On the overall basis, farm income constituted major proportion of total income (91.16 percent) as compared to non-farm income (8.84 percent).The household expenditure pattern indicated average annual expenditure was ₹236303 per household of total sampled farmers. The expenditure on food was the major item head, which was estimated to be ₹106158 per household per annum and constituting about 45 percent of total expenditure. On the other hand, average annual general expenditure (other than routine household expenditure including social/religious ceremonies, construction of house, major medical expenses, purchase of durables, etc.) was ₹180618 per household/ per annum of total sampled farmers. Out of the total general expenditure, the expenditure on marriage ceremonies was maximum that was 40.48 percent of total general expenditure.

Sources of Agricultural Credit Availed by Sampled Farm Households

Farmer has credit requirement both for short term and long-term purposes. Short-term credit refers to that credit which is usually granted for a period of six to 18 months for the short term production needs like paying the wages to workers, buying fertilizers, pesticides, seeds etc. mainly to take care of variable farm expenses so also called crop loans. On the other hand, long-term credit refers to that credit which is provided for a period of more than 18 months for purchasing new land, land development, improving irrigation structure, cattle shed etc. also called term loans.

Short-term Credit Availed by Sampled Farmers

Source and category wise credit availed by sampled farms for short-term credit needs has been shown in Table 1. Table showed that on the overall basis, 25.56 percent of the sampled farmers were borrowing only from institutional sources, while 14.44 percent only from non-institutional sources and 60 percent of the sampled farmers were found to be availing credit from both the sources. So, incidence of borrowing in terms of number of borrowers from institutional sources was found to be higher on sampled farmers as compared to non-institutional sources.

Table1. Source and category wise sampled borrower farmers for short-term credit needs in Punjab, 2015-16

(Number)

Household category	Source of borrowing		
	Institutional	Non-institutional	Both
Small	9 (31.03)	8 (27.58)	12 (41.38)
Medium	12 (22.22)	5 (9.26)	37 (68.51)
Large	2 (28.57)	-	5 (71.43)
Total	23 (25.56)	13 (14.44)	54 (60.00)

Figures in the parentheses indicate the percentages to total number of farmer of respective farm category.

The category-wise 31.03 percent of the small farmers were borrowing from the institutional sources whereas the respective figures for the medium and large farmers were 22.22 and 28.57 percent. On the other hand, 27.58 percent small farmers were tapping the non-institutional

sources of credit, whereas the respective figure for the medium farmers was 9.26 percent. None of the large farmer was found to be borrowing only from non-institutional sources. In the case of both, that is, those farmers which were borrowing from both institutional as well as non-institutional sources, 41.38 percent were in small farm category, while 68.51 and 71.43 percent in medium and large farms respectively. So it was concluded that sampled farmers belonging to all the farm categories borrowed more from institutional source of credit for short-term credit needs.

Agency wise split of credit source

Agency wise split of credit source tapped by sampled farmers has been given in Table 2. In the case of institutional source of credit, commercial banks have emerged as the main source as 55.56 percent of the sampled farmers were borrowing only from this source, while the respective figures for the cooperative societies were 15.56 and 14.44 percent of the farmers were borrowing from both of these sources. On the other hand in case of non-institutional sources of credit, commission agents were dominant source of credit as 63.33 percent were borrowing only from this source. Number of the farmers borrowing from only landlords and relatives/friends were 5.55 and 3.33 percent respectively. Only two percent of the farmers were borrowing from all these sources. Category-wise analysis showed that in case of institutional sources, farmers were borrowing more from commercial banks as compared to co-operative societies across all the farm categories. On the other hand in case of non-institutional sources, majority of the farmers were borrowing more from commission agents as compared to other agencies.

Extent of short-term credit

Extent of borrowing by sampled respondents has been shown in Table 3. It showed that on an overall basis,

Table 2. Agency wise split of short-term credit source of the sampled farmers in Punjab, 2015-16

(Percent)

Household	Source of borrowing						
	Institutional sources			Non-institutional sources			
	Primary agricultural co-operative societies	Commercial Banks	Both	Commission agents	Landlords	Relatives and friends	All
Small (n_1=4)	10.34	0.52	10.34	48.27	10.34	6.89	3.44
Medium (n_2=54)	18.51	53.70	18.52	70.37	3.70	1.85	1.85
Large (n_3=7)	14.28	85.71	-	71.43	-	-	-
Total	15.56	55.56	14.44	63.33	5.55	3.33	2.22

Figures in the parentheses indicate the percentages to total number of farmer of respective farm category.

Table 3. Extent of short-term credit availed by sampled farmers in Punjab during the year, 2015-16

(₹/farm)

Source of loan	Small	Medium	Large	Overall
A. Institutional Sources				
Commercial bank	147586	358704	500000	301666
	(91.06)	(86.73)	(95.89)	(88.47)
Primary agricultural co-operative societies (PACS)	14483	54907	21428	39277
	(8.94)	(13.27)	(4.11)	(11.53)
Sub-total (A)	162069	413611	521428	340943
	(41.92)	(61.80)	(60.34)	(57.46)
B. Non-institutional sources				
Commission agents	162069	240741	342857	223333
	(72.20)	(94.20)	(100.00)	(88.50)
Landlord	34482	5555	-	14444
	(15.36)	(2.17)		(5.72)
Relatives	27931	9259	-	14555
	(12.44)	(3.63)		(5.77)
Sub-total (B)	224482	255555	342857	252332
	(58.07)	(38.20)	(39.66)	(42.54)
Grand total (A+B)	386551	669166	864285	593275
	(100.00)	(100.00)	(100.00)	(100.00)

Figures in the parentheses indicate the percentages to total.

the extent of borrowed amount by sampled farmers was ₹593275 per farm household. Amount borrowed from institutional and non-institutional sources was 57.46 percent and 42.54 percent per farm respectively. So overall, farmers were availing higher amount from institutional sources of credit. Agency wise split showed that in case of institutional sources of credit, borrowing was more from commercial banks (88.47 percent) while amount borrowed from primary agricultural co-operative societies was 11.53 per farm. In the case of non-institutional sources of credit, amount was borrowing more from commission agents (88.50 percent) as compared to landlords (5.72 percent) and relatives (5.77 percent).

Category-wise, amount borrowed from institutional sources was more in the case of medium (61.80 percent)and large farmers (60.34 percent) as compared to non-institutional sources, while small farmers borrowed more from non-institutional sources (58.07 percent) as compared to institutional sources (41.92 percent). In the case of institutional sources, all the farm categories have been borrowing more from the commercial banks as compared to primary agricultural co-operative societies (PACS). On the other hand, in case of non-institutional sources, farmers were borrowing more from commission agents. Only small and medium farmers were borrowing from landlords and friends/relatives. None of the large farmers had borrowed from these sources.

Purpose and Source-wise Extent of Long-term Credit Availed by Farmers in Punjab

Long-term credit refers to that credit which is provided for a period of more than 18 months for purchasing new land, land development, improving irrigation structure, cattle shed etc. also called term loans. As shown in Table 4 the extent of average amount availed by the sampled farmers during the last five years was worked out to be ₹383154 per farm in the study area. On the overall basis, 47percent of the amount was borrowed from non-institutional sources and 53 percent from institutional sources of credit. In case of small farmers, 64 percent of the borrowing was from institutional sources and 36 from non-institutional sources for the long-term purpose, while the respective figures for medium farmers were 53 and 47 percent. Large farmers were found to be borrowing from both the sources in an equal proportion.

In long-term loans, borrowing was for both productive and non-productive purposes. On the overall basis out of the total loan provided for productive purpose, 58 percent was from institutional sources and 42 percent from non-institutional sources. It showed that for the productive purposes institutional sources of credit were playing an important role. In case of small farmers,

Table 4. Extent of long-term average credit availed by sampled farmers during last five years in Punjab (2011-12to 2015-16)

(₹/farm)

Source	Small		Medium		Large		Overall	
	Amount	Percent to total	Amount	Percent to total	Amount	Percent to total	Amount	Percent to total
Productive purpose								
Institutional	32000 (39.03)	55	131482 (53.38)	58	142857 (40.00)	62	100311 (49.67)	58
Non-institutional	25700 (55.03)	45	95185 (43.44)	42	88572 (19.87)	38	72280 (39.89)	42
Sub-total	57700 (44.83)	100	226667 (48.71)	100	231429 (28.82)	100	172591 (45.05)	100
Unproductive purpose								
Diversion of institutional credit	50000 (60.97)	70	114815 (46.62)	48	214286 (60.00)	38	101667 (50.33)	48
Non-institutional	21000 (44.97)	30	123919 (56.56)	52	357143 (80.13)	62	108896 (60.11)	52
Sub-total	71000 (55.17)	100	238734 (51.29)	100	571429 (71.18)	100	210563 (54.95)	100
Total loan								
Institutional	82000 (100.00)	64	246297 (100.00)	53	357143 (100.00)	50	201978 (100.00)	53
Non-institutional	46700 (100.00)	36	219104 (100.00)	47	445715 (100.00)	50	181176 (100.00)	47
Grand total	128700 (100.00)	100	465402 (100.00)	100	802858 (100.00)	100	383154 (100.00)	100

Figures in the parentheses represent the percent share to the total loan of respective source.

out of the total loan provided for productive purposes, 55 percent was from institutional sources and 45 percent from non-institutional sources, while in case of medium farmers respective figures were 58 and 42 percent. In case of large farmers, 62 percent of loan was from institutional sources and 38 percent from non- institutional sources for productive purposes. It showed that for productive purposes sampled farmers were availing more credit from institutional sources.

On the other hand for the non-productive purposes, on overall basis, out of total loan provided, 48 percent was from the institutional sources and 52 percent from non-institutional sources of credit. None of the institutional source directly provided the credit for the non-productive purposes, but it was the diversion of institutional credit availed by the farmers for productive purposes to non-productive purposes. It showed that for non-productive purposes, higher proportion of loan was from non-institutional sources. In case of small farmers, out of the total loan utilized for the non-productive purposes, 70 percent of the amount borrowed was from institutional (diverted) sources and 30 percent from non-institutional sources, while the respective figures for the medium farmers were 48 percent and 52 percent and for large farmers were 38 percent and 62 percent respectively. It showed diversion of institutional credit for non-productive was more in small farm category whereas medium and large farmers were availing more of non-institutional credit for non-productive purposes.

On the overall basis, out of the total institutional loan, about 49.67 percent was utilized for productive purposes and 50.33 percent diverted towards non-productive purposes, while out of the total non-institutional credit 39.89 percent was being utilized for productive purposes and 60.11 percent for non-productive purposes. This showed that proportion of non-institutional credit for unproductive purposes was found to be more whereas proportion of institutional credit was same for both productive and unproductive purposes.

Table 5. Source-wise extent of loan availed by the sampled farmers for productive purposes in Punjab, 2015-16

(₹/farm)

Source	Small		Medium		Large		Overall	
	Amount	Percent to total	Amount	Percent to total	Amount	Percent to total	Amount	Percent to total
Farm equipment and implements								
Institutional	6000	59.00	44400	53.00	53700	63.00	32750	54.00
Non-institutional	4200	41.00	40050	47.00	31000	37.00	27794	46.00
Sub-total	10200	100.00	84450	100.00	84700	100.00	60544	100.00
	(18.00)		(37.00)		(37.00)		(35.00)	
Irrigation structures								
Institutional	18000	72.00	38700	59.00	47800	64.00	32738	61.00
Non-institutional	7000	28.00	27100	41.00	27000	36.00	20615	39.00
Sub-total	25000	100.00	65800	100.00	74800	100.00	53353	100.00
	(43.00)		(29.00)		(32.00)		(31.00)	
Dairy animals and cattle shed								
Institutional	8000	39.00	27000	57.00	21242	64.00	20430	54.00
Non-institutional	12700	61.00	20100	43.00	12000	36.00	17086	46.00
Sub total	20700	100.00	47100	100.00	33242	100.00	37516	100.00
	(36.00)		(21.00)		(14.00)		(22.00)	
Farm buildings								
Institutional	0	0	21382	73.00	20115	52.00	14393	68.00
Non-institutional	1800	100.00	7935	27.00	18572	48.00	6785	32.00
Sub total	1800	100.00	29317	100.00	38687	100.00	21178	100.00
	(3.00)		(13.00)		(17.00)		(12.00)	
Total loan for productive purpose								
Institutional	32000	55.00	131482	58.00	142857	62.00	100311	58.00
Non-institutional	25700	45.00	95185	42.00	88572	38.00	72280	42.00
Grand total	57700	100.00	226667	100.00	231429	100.00	172591	100.00
	(100.00)		(100.00)		(100.00)		(100.00)	

Figures in the parentheses represent the percent share to the grand total.

Source-wise Extent of Loan Availed by the Sampled Farmers for Productive Purposes

Productive loan refers to the extent of loan taken by the sampled farmers for upgrading the farm structure. In connection to the above analysis, it is important to see the borrowing of loan for productive purpose under different item heads and the results were given in Table 5. Out of the total loan taken for productive purpose, the average amount of loan borrowed for purchasing farm equipments & implements during the last five years was ₹60544 per farm which accounted 35 percent share in the total loan overall in the study area. It was observed that in Punjab groundwater tables was continuously going down which needs to develop irrigation structure, like by installing submersible motors and for such irrigation structure farmers approached financing agencies. Farmers also need credit for the construction activities like cattle shed and farm building. The amount of loan taken for developing irrigation structure, dairy animals and cattle shed, and farm building came to be ₹53353, ₹37516, ₹21178 which constituted 31, 22, and 12 percent of the total loan, respectively. The share of institutional loan to the total loan availed for productive purposes with respect to farm equipments & implements, irrigation structure, dairy animals & shed and farm building worked out 54, 61, 54, and 68 percent respectively, while the corresponding figure for non-institutional sources 46, 39, 46, and 32 percent, respectively.

The extent of productive credit across the categories showed that for upgrading farm equipments & implements, developing irrigation structures, dairy animals and cattle shed and farm buildings came out to ₹10200, ₹25000, ₹20700 and ₹1800 in case of small farmers respectively, while the corresponding figure in case of medium farmers were ₹84450, ₹65800 and ₹47100 and large farmers were ₹84700, ₹74800, ₹33242 and ₹38687 respectively. Purpose wise analysis showed that out of the total loan provided for the productive purposes, small farmers availed the higher proportion of their loan to improve their irrigation structure while medium and large farmers borrowed higher proportion on purchasing farm equipments and implements.

Table 6. Source-wise extent of loan availed by the sampled farmers for non-productive purposes in Punjab, 2015-16

(₹/farm)

Source	Small		Medium		Large		Overall	
	Amount	Percent to total	Amount	Percent to total	Amount	Percent to total	Amount	Percent to total
House construction								
Institutional	11000	79	40000	52	52000	46	31589	53
Non-institutional	3000	21	37400	48	60000	54	28073	47
Sub-total	14000 (20)	100	77400 (32)	100	112000 (20)	100	59662 (28)	100
Marriage ceremonies								
Institutional	18000	72	38500	50	112000	38	37611	74
Non-institutional	7000	28	38000	50	180000	62	13127	26
Sub-total	25000 (35)	100	76500 (32)	100	292000 (51)	100	50738 (24)	100
Purchase of durables								
Institutional	6600	69	14315	36	31000	28	13127	37
Non-institutional	2900	31	25119	64	79143	72	22161	63
Sub-total	9500 (13)	100	39434 (17)	100	110143 (19)	100	35288 (17)	100
Major medical treatment								
Institutional	14400	64	22000	48	19286	34	19340	50
Non-institutional	8100	36	23400	52	38000	66	19606	50
Sub-total	22500 (32)	100	45400 (19)	100	57286 (10)	100	38946 (18)	100
Total loan for non-productive purpose								
Institutional	50000	70	114815	48	214286	38	101667	48
Non-institutional	21000	30	123919	52	357143	62	108896	52
Grand total	71000 (100)	100	238734 (100)	100	571429 (100)	100	210563 (100)	100

Figures in the parentheses represent the percent share to the grand total.

Source-wise Extent of Loan Availed by the Sampled Farmers for Non-productive Purposes

The results pertaining to loan taken by the sampled farmers for non-productive purposes under different item heads has given in Table 6. Out of the total unproductive loan, an average amount of loan on per farm basis for house construction was found to be ₹59662 which accounted 28 percent in the total loan on an overall farm situation. Wedding ceremony was found another major item head involving unproductive expenditure. The pattern of expenditure has been considerably increased in order to maintain social status particularly in the rural areas of Punjab. The extent of loan borrowed on account of this purpose was estimated to the tune ₹50738 per farm which constituted 24 percent to the total unproductive loan. The extent of loan taken by the respondent farmers with respect to purchase of durables and medical treatment came out ₹35288 and ₹38946 per farm, respectively. The share of institutional loan to the total loan availed for unproductive purposes with respect to house construction, marriage ceremonies, purchase of durables and major medical expenses worked out 53, 74, 37, and 50 percent respectively, while the corresponding figure for non-institutional sources were 47, 26, 63, and 50 percent, respectively.

The analysis across the categories showed that extent of unproductive loan borrowed for house construction, marriage ceremonies, purchase of durables and major medical expenses came out to ₹14000, ₹25000, ₹9500 and ₹8100 in case of small farmers respectively, while the corresponding figure in case of medium farmers were ₹77400, ₹76500, ₹39434 and ₹45400 and for large farmers were ₹112000, ₹292000, ₹110143, and ₹57286 respectively. Purpose wise analysis showed that out of the total loan availed for unproductive purposes, marriage ceremonies have emerged as the major cause of borrowing in all categories.

Reasons for the Preference of Institutional Source of Credit

Preference by the sampled farmers approaching institutional sources in the study area has been shown in Table 7. Low rate of interest charged by institutional agencies emerged as top most reason. It was followed by credit limit formed by the agency, old account with the agency and personal relation with the agency staff as factors for preference of institutional sources of credit. However, secrecy of loan, access to the agency, timelines, and formalities of loan process scored low on preferential scale of farmer.

Reasons for the Preference of Non-institutional Source of Credit

On similar lines, the reasons for the preference of non-institutional source of credit have been shown in Table 8. Here easy access was the topmost factor followed

Table 7. Reasons for the preference of institutional sources of credit by sampled farmers in Punjab, 2015-16

Factors	Rank								Total no. of respondents	Total score	Mean score	Rank
	1	2	3	4	5	6	7	8				
Rate of interest	0	64	5	8	0	0	0	0	77	5084	56.49	1
Credit limit	0	57	20	0	0	0	0	0	77	5076	56.4	2
Old accounts or debts	11	15	48	2	1	0	0	0	77	4935	54.83	3
Personal relations	0	0	1	68	4	2	1	1	77	4056	45.06	4
Secrecy	0	0	1	2	63	9	0	2	77	3540	39.33	5
Access	0	0	0	3	2	34	29	9	77	2796	31.06	6
Timelines	0	1	0	0	2	6	36	27	77	2163	24.03	7
Formalities	0	0	0	7	4	24	4	38	77	2480	27.55	8

Table 8. Reasons for the preference of non-institutional sources of credit by sampled farmers in Punjab, 2015-16

Factors	Rank								Total No. of respondents	Total score	Mean score	Rank
	1	2	3	4	5	6	7	8				
Easy access	4	41	21	0	0	0	0	0	66	4448	49.42	1
Low formalities	25	7	10	5	19	0	0	0	66	4299	47.76	2
All purposes credit	21	11	4	8	8	4	8	2	66	4014	44.6	3
Timelines	2	6	13	22	0	5	10	8	66	3293	36.59	4
Secrecy	6	0	7	24	7	2	15	5	66	3254	36.16	5
Old accounts or debts	0	1	7	5	16	25	10	2	66	2928	32.53	6
Personal relations	0	21	7	5	16	25	10	2	66	2940	32.67	7
Rate of interest	0	0	0	0	0	4	23	39	66	1763	19.58	8

by low formalities, all purposes credit and timeliness in providing credit. However, secrecy of loan, old accounts, personal relation with the commission agencies, and high rate of interest charged by these scored low on preferential scale of farmers.

CONCLUSIONS

Farmers were found to be borrowing from both the institutional and non-institutional sources for their short-term as well as long-term credit needs. In the present study, it was observed that for the both short-term as well as long-term credit needs, majority of the farmers were borrowing from the institutional source of credit and commercial banks were their main suppliers of credit. In long-term, farmers were borrowing both for productive and unproductive purposes. None of the institutional source was directly provide the credit for unproductive purposes; it was the diversion of institutional credit for unproductive purposes. It was observed that for productive purposes higher amount of credit was borrowed from institutional sources while for unproductive purposes borrowing from non-institutional sources was found to be higher.

REFERENCES

Choubey M., & Singh, R.P. (2003). Interlinked rural credit markets in Rajasthan: Status and policy implications. *Journal of Agricultural Development and Policy*, *15,* 43-56.

Gill, A. (2004) Interlinked agrarian credit markets: Case study of Punjab. *Economic and Political Weekly, 39*, 3741-3751.

Kumar, A., Singh, K.M., & Sinha, S. (2010). Institutional credit to agricultural sector in India: Status, performance, and determinants. *Agricultural Economics Research Review, 23,* 253-264.

Sidhu, R.S., & Gill, S.S. (2006). Agricultural credit and indebtedness in India: Some issues. *Indian Journal of Agricultural Economics,61,* 11-34.

Toor, J.S., Tiwana, B.S., & Singh, S. (2016). Rural indebtedness in Malwa region of Punjab. *Indian Journal of Economics and Development,12,* 431-438.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 272-276
DOI: 10.5958/2322-0430.2018.00070.7

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Determinants of Credit Availability among Farmers: A Case of Banana Tissue Culture[§]

J. Sebastian[1], P. Kumar[2], G.K. Jha[2] and K.V. Praveen[3]*

[1]Ph.D. Scholar, [2]Principal Scientists, and [3]Scientist, Division of Agricultural Economics
ICAR- Indian Agricultural Research Institute, New Delhi-120011

[*]Corresponding author's email: sebastianjobin77@gmail.com

Received: December 18, 2017 *Manuscript Number: NS-18-24* *Revision Accepted: February 12, 2018*

ABSTRACT

The technological improvements play vital role in enhancing the yield of agricultural crops. Tissue culture technology is a major intervention in banana, which have the potential to benefit the banana farmers in multiple ways. We have tested this by using primary survey of 100 farmers from the Gorakhpur district of Uttar Pradesh, a traditional sugarcane cultivated belt which is fast getting covered by banana plantations. Both adopters and non-adopters were surveyed and their adoption nature was studied by calculating cost and returns along with probit regression by using Hackman's selection bias model. It was found that availability of credit which affects the adoption behavior of farmers significantly along with age and farm income. Farmers those who are availing institutional credit mainly in the form KCC and term loans show more adoption behavior as compared to non-loanee farmers. The risk due to wind, drought and other abiotic factors were identified as the major constraints in the adoption of tissue culture banana in the region. Study emphasize the need for more financial assistance in the form of rural institutional credit, adequate and timely availability of quality inputs (especially planting materials) for better returns and thereby more adoption of high value crops.

Keywords
Heckman's two-step procedure, Probit regression, Sucker propagated banana, Tissue culture banana.

JEL Codes
H81, O33, Q12, Q14, Q16.

INTRODUCTION

Horticulture is now one of the best performing sector among all the agricultural sectors of the country (Idris *et al.,* 2015). The change in dietary preference of Indian consumers towards high-value commodities along with better income of the urban consumers have in the recent period favoured horticulture production of India (Verma *et al*., 2007). Out of India's total horticultural production, the share of total fruits in area and production are 26.9 and 32.3 percent respectively. Banana is a very important part of the diet of consumers all over the country and hence it occupies the leading position in production among all fruits, with a contribution of 291 lakh tonnes (NHB, 2016). The production of banana has advanced drastically along with the advent of tissue culture technology. Tissue culture technique is gaining more acceptance among farmers in comparison to the traditional sucker propagated banana. This is because tissue culture technology is able to satisfy the farmers by providing planting materials having desirable qualities like uniform bunching, pest, and disease-free planting material, better response to inputs (Drew &Smith, 1990; Singh & Shetty, 2011). Studies also show a significant yield increase in tissue culture banana plantlets in comparison with the traditional sucker propagated ones. The cultivars like Grand Naine have the advantage of about 13 percent yield increment in the field conditions (Robinson *et al.,* 1993).

Plant species micro-propagated by Indian commercial units indicate that most of the units are solely producing banana due it's ample demand and better

[§]This paper is drawn from the M.Sc. thesis entitled Impact of credit on adoption of high value crop: A case of banana cultivation of the first author submitted to the Division of Agricultural Economics, ICAR-Indian Agricultural Research Institute, New Delhi, in 2016.

farmers' acceptability. The micro-propagation industry is particularly well suited for a country like India as it is environment-friendly and labor-intensive (Govil & Gupta, 1997). However, the adoption of tissue culture technology by small and marginal farmers are still lagging behind due to the constraints like high cost and low subsidy for planting material, non-availability of area-specific varieties, lack of special marketing for tissue culture banana, and high risk and investment involved in the cultivation (Ananda, 2007).

Uttar Pradesh is one state, where the banana cultivation is picking up. In recent years a large number of farmers in Gorakhpur district of Uttar Pradesh, who were traditionally engaged in sugarcane cultivation, have shifted to banana farming for better returns. However the adoption of banana, especially the tissue culture one is not very easy for them. This is because of the lack of financial capital. Research has also suggested that farmers with less access to credit plant fewer high yielding crop varieties. In many developing countries, and particularly in rural areas, access to financial services, including credit and formal saving mechanisms, is limited. Even where financial services are available, they are often highly disadvantageous to smallholder farmers. The assessment of adoption and acceptability of banana farming in this region which is not a traditional area of banana cultivation would give some meaningful insights for policymakers. Thus an attempt is made here to analyze the impact of credit and other enabling factors on adoption of tissue culture banana and the determinants of credit availability among farmers in Gorakhpur district of Uttar Pradesh.

DATA AND METHODOLOGY

Gorakhpur district in Uttar Pradesh falls in the eastern sector of the Indo Gangetic plain and it is composed of 7 tehsils and 19 community blocks. Gorakhpur district was purposively selected as it contributes 33 percent of the total area and production of banana cultivation in Uttar Pradesh which is highest among all the districts. At the next stage, Jangalkaudia and Campiereganj blocks of the Gorakhpur district were randomly selected. From each blocks, a cluster of 4 villages were randomly selected and a total of 50 farmers were randomly surveyed. Thus a total of 100 farmers spread over 8 villages comprising 63 tissue culture adopters and 37 sucker propagated banana growers comprised the sample for the study. Primary data was collected using structured schedule on aspects like socioeconomic characteristics of farmers, Institutional variables, Credit and subsidy available, Financial liabilities, storage and marketing of produce, impact of banana cultivation on, household income, consumption expenditure, expenditure on education, social expenditure and investment on farm and non-farm activities. The opinion of farmers on factors influencing and constraints to adoption of tissue culture technology was also collected.

Various components of cost and returns of banana cultivation were computed and compared between tissue-culture adopters and non-adopters to examine the profitability of tissue culture adoption. For finding out the impact of credit on adoption and other enabling factors, Probit model regression with Heckman two-step procedure were used. Heckman two-stage procedure is a multivariate analysis to assess the impact of credit on adoption of tissue culture banana from other intervening factors.

Step 1- Estimation of the factors influencing the credit

$$Y_i = \sigma + \delta X_i + \mu_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where,

Y_i is a latent variable representing the propensity of a firm 'i' to go for credit.

X_i is the factors that influence to go for credit:

X_1= Land owned (ha)

X_2=Age (No. of years of schooling)

X_3=Education (No. of years of schooling)

X_4=Total farm income

X_5= Farming experience (₹)

X_6= Category in which the farmer belongs

X_7=Member of any organization

X_8=KCC holder/Non-KCC holder

Employing a maximum likelihood estimation procedure, the probability of the farmer to become loanee is obtained from the first stage of the Heckman two-step technique. This involves a probit regression to predict the probability of taking credit. Using these estimates, a variable known as inverse Mills ratio is obtained:

$$\lambda_i = \varphi(\rho + \delta X_i)/\varphi(\rho + \delta X_i) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where,

φ is the cumulative distribution function of a standard normal distribution and

λ_i is the inverse mills ratio term

Step 2-Estimation of impact of credit on adoption

The second step is adding mills ratio to the adoption equation. The factors that determine adoption of TCB is explicit in the literature and they include

W_1=Land owned (ha)

W_2=Age (years)

W_3=Education

W_4=Extension contact

W_5=Total farm income (₹)

W_6=Category

Apart from this credit (W7) and inverse Mills ratio (λ_i) are adding as independent variables.

The adoption equation,

$$A_i = \beta_0 + \beta_1 W_i + \beta_2 Y_i + \beta_3 \lambda_i + U_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where,

E (U) = 0

A_i is the binary variable which indicates the farmer is adopter or not.

W_i is a vector indicates the factors enabling the adoption of TCB.

λ_i is the inverse mills ratio.

Y_i is a dummy variable which is 1 for adopters and 0 for non-adopters.

To find out the constraints in adoptionof tissue culture technology, the Garett Ranking Technique was used. As the first step, the respondents were first to rank the enlisted factors. The order assigned by the respondents were converted into percentage position using the formula

$$\text{Percentage position} = 100 \times (R_{ij} - 0.5)/N_j$$

Where R_{ij} is the rank given for i^{th} factor by j^{th} individual and N_j is the number of factors ranked by j^{th} individual. The relative position of each rank obtained from the above formula was converted into scores by referring to the table given by Garett (transformation of orders of merit into units of amount of scores) for each factor; scores of all individuals were added and then divided by the total number of respondents for the specific factor (constraint).Finally, mean scores for all the factors were arranged in descending order according to ranks

Table 1 shows the socioeconomic characteristics of the sample farmers. Significant difference was observed among the adopters and non-adopters of tissue culture banana in characters like average size of holding, family size, and distance from the market at 5 percent level of significance and in farming experience, average size of banana cultivation and average annual income at 1 percent level of significance. Average size of holding was significantly higher in case of tissue culture adopters as compared to non-adopters. Also, the figures showed that farmers having less farming experience are better adopters of technology. Average annual income also differed significantly between adopter and non-adopter categories of farmers.

Table 1. Socio-economic characteristics of sample farmers

Descriptions	Adopter	Non-adopter	p-value (t-test)
Average size of holding (ha)	2.52	2.07	0.08**
Average age (years)	37.87	56.81	2.81 NS
Family size (numbers)	2.68	3.21	0.08**
Farming experience (years)	13.03	17.86	0.00***
Average years of schooling (years)	11	6	2.75 NS
Average area of banana cultivation (ha)	2.31	1.41	0.00***
Distance from the input dealer (km)	8.51	3.91	1.04NS
Distance from the market (km)	7.57	11.28	0.09**
Average annual income (₹)	109984	62243	0.00***

****, ** and *** Significant at 10, 5 and 1 percent levels, respectively.***
NS: Non-significant.

Table 2. Cost and returns from Banana cultivation

Particulars	Tissue culture		Sucker propagated	
	₹/ha	Percent	₹/ha	Percent
Family Wages	2205	2.3	4291	4.92
Hired Wages	20025	21.0	18571	21.31
Machinery charges	7163	7.5	7318	8.40
Planting material	44811	47.1	22104	25.38
FYM	3595	3.7	2955	3.39
Chemical Fertilizers	13868	14.6	12719	14.60
Plant protection chemical	5510	5.8	3791	4.35
Propping	8670	9.1	5987	6.87
Harvesting	9657	10.1	6889	7.91
Others	2985	3.1	2456	2.82
Total input costs	94972	100.0	87081	100.00
Total fixed cost	116604		69176	
Total cost(Cost C_3)	211576		156257	
Gross income	468732		372134	
Net income	257156		215877	

Cost allocation results for tissue culture banana indicated that planting material cost (47.1 percent) constitutes the highest share in the total variable costs followed by hired wages (21 percent) and chemical fertilizers (14.6 percent). Marginal category of farmers bears highest variable cost content as compared to the other category of farmers. Under tissue culture banana production, planting material cost hired labor cost, chemical fertilizer cost and harvesting cost were the major four cost components which contributes the maximum shares. Substantial decrease in the production cost can be achieved by using plantlets having a lower price. Economics of sucker propagated banana showed the same trend for tissue culture banana. The cost of planting material accounts the major share, followed by hired labor charge, cost of chemical fertilizers and cost of harvesting. Total variable cost was highest in the case of planting material (25.38 percent) followed by hired labor (21.31 percent) and chemical fertilizers (14.60 percent). The difference between planting material cost and hired labor cost was very low against tissue culture cost components.

In general tissue culture adopted farmers realized higher returns than that of non-adopters. The adopted farmer with an incremental expenditure of ₹7891 get an incremental net income of ₹41279 over that realized by non-adopted farmers.

Probit with Hackman's two-stage sample selection bias model

In the first step of Heckman's approach, a probit model was estimated to identify the factors that influence a farmers' decision as to whether or not to go for credit. Land owned, age, educational attainment, total farm income, farming experience, religious category of the farmers, holder of Kisan credit card and membership of any social organizations were the factors considered that could influence their decision to take up tissue culture technology. The probability of taking credit was significantly influenced by age, category and KCC membership. These three variables were significant at 5 percent level. Age was negatively associated with the dependent variable. The repayment capacity of loan was higher in working-age category of farmers. So, the variable was negatively correlated with the probability of taking credit. The chance of taking loan by KCC holders were obviously high, and thus it also significantly affected the access to credit.

In the second stage of two-step procedure after adding the Mills ratio to the adoption equation, probit regression gives the significance levels of factors that influence the adoption of tissue culture banana. The factors that determine adoption of tissue culture were mostly socio-economic characteristics of the households. These include the total land owned, age of the head, his education level, extension contact, total farm income, and religious category. From the results, the coefficient of inverse mills ratio was found to be negative and was not significantly different from zero which indicated the absence of selectivity bias in the sample. Five variables including age credit drawn, extension contact, total farm income, and category were found to be significant, and except age, all others were having a positive response towards adoption of TCB. Moreover, age was significant at 1 percent level, as compared to other variables, which were significant at 5 percent level. More importantly credit, which was significant at 5 percent level bears a coefficient of 0.89, meaning that a 1 unit change in credit access results in 0.89 unit increase in adoption behavior of farmers. It can also be inferred that credit component

Table 3. Determinants of farmer's access to credit

Variables	Coefficient	SE	p-value
Constant	0.06	0.83	0.94
Land owned (ha)	0.02	0.12	0.82
Age	-0.02**	0.01	0.08
Education	0.01	0.03	0.75
Total farm income	0.00	0.00	0.57
Farming experience	0.02	0.02	0.39
Category	0.67**	0.31	0.03
Member of any organization	0.04	0.28	0.87
KCC holder	0.63**	0.30	0.03
χ^2	28.19***		

***and *** Significant level at 5 and 1 percent, respectively.*
SE: Standard Error.

Table 4. Determinants of adoption of tissue culture banana

Variables	Coefficient	SE	p-value
Intercept	1.56	1.89	0.40
Land owned(ha)	0.02	0.25	0.91
Age	-0.09***	0.03	0.00
Education	0.01	0.05	0.81
Credit drawn	0.89**	0.55	0.07
Extension contact	1.49**	0.62	0.01
Total farm income	0.01**	0.00	0.07
Category	1.61**	0.79	0.04
Inverse mills ratio	-0.45	1.39	0.74

***and *** Significant level at 5 and 1 percent, respectively.*
SE: Standard Error.

Table 5. Constraints in tissue culture banana production

Constraint	Score	Rank
Natural calamities (wind, drought)	87	I
Lack of availability of good quality plantlets and inputs	79	II
High price of plantlets	77	III
Insurance benefits	76	IV
Reliable market facility	72	V
Storage facilities	69	VI
shortage of labor	59	VII

increases tissue culture adoption by 0.89 units relative to that of non-credit-holders. Again the coefficient of age is negative, which indicated the fact that the adoption rate was higher in young farmers. Extension contact was another significant variable which showed a coefficient of 1.49.This shows that technology dissemination has a significant influence in the adoption behavior of farmers.

The results of the Garett ranking for assessing the constraints for adoption of tissue culture technology presented in the Table 5 show that maximum score 87 was given to natural calamities; wind and drought since the place is highly vulnerable to these threats. Quality of inputs including, planting material in most of the cases was found to be inferior. Because of this, it was ranked second in the Table 5 with a mean score of 79.

In addition to this high price of plantlets and lack of insurance benefits were also major constraints in adoption of tissue culture banana cultivation. Eastern Uttar Pradesh is highly prone to natural calamities especially high wind and drought. In case of banana, the chance of lodging is higher because of its physiological characteristics. Gorakhpur farmers were well-acquainted with all these adverse situations but the current risk mitigating strategies were not adequate enough to cover the risk. Apart from these, the quality of plantlets were found degrading over the years and it was gradually becoming highly prone to plant diseases. The farmers were worried about the quality of plantlets and other input materials since it secured the second position in the Garett table.

CONCLUSIONS

Results showed that the net income of tissue culture banana adopters are about 17 percent higher than the non-adopters. Loanee farmers were gaining more income as compared to the non-loanee farmers. Probit regression along with Heckman two-step procedure results clearly factors out the impact of credit on tissue culture adoption. Most of the adopter farmers were loanee in nature but non-adopter farmers comprised of both loanee and non-loanee categories more or less equally. Out of the loanee farmers, majority were accessing institutional credit. They access the credit mainly through KCC under crop loan. Results clearly indicated that age was significant and negatively related to the probability of taking credit. Adoption of TCB was positively related with credit drawn, extension contact, total farm income, and category. This indicates the capital necessary for cultivation by marginal and small category of farmers. Extension contact in the forms of training, expert suggestions etc. are needed for the adoption of a technique like tissue culture. Most of the farmers in the area were resource-poor farmers and they solely depend on agriculture for their livelihood. So the credit support help those farmers directly or indirectly to adopt improved technology. Farm infrastructure development is an essential part which enhances the production in farm level. Weather risk due to drought and wind and unavailability of good quality plantlets were the important constraints identified from the study area.

REFERENCES

Ananda, R.G. (2007). *A study on impact of tissue culture banana cultivation in Andhra Pradesh* (Master's Thesis). Acharya N.G. Ranga Agricultural University Hyderabad).

Drew, R.A., & Smith, M.K. (1990). Field evaluation of tissue-cultured bananas in south-eastern Queensland. *Animal Production Science, 30*(4), 569-574.

Govil, S., & Gupta, S.C. (1997). Commercialization of plant tissue culture in India. *Plant Cell, Tissue and Organ Culture, 51*(1), 65-73.

Idris, S., Singh, A., & Praveen, K.V. (2015). Trade competitiveness and impact of food safety regulations on market access of India's horticultural trade. *Agricultural Economics Research Review, 28*(2).301-309.

NHB. (2016). *NHB database 2015-16*. Department of Agriculture, Cooperation, and Farmers Welfare, Ministry of Agriculture, Government of India, New Delhi.

Robinson, J.C., Fraser, C., & Eckstein, K. (1993). A field comparison of conventional suckers with tissue culture banana planting material over three crop cycles. *Journal of Horticultural Science, 68*(6), 831-836.

Singh, G., & Shetty, S. (2011). Impact of tissue culture on agriculture in India. *Biotechnol Bioinforma Bioeng*, *1*, 147-158.

Verma, M.R., Datta, K.K., Mandal, S., & Tripathi, A.K. (2007). Diversification of food production and consumption patterns in India. *Journal of Agricultural and Food Information, 8*(3), 87-100.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 277-281
DOI: 10.5958/2322-0430.2018.00071.9

NAAS Score: 4.82
www.naasindia.org
UGC Approved

A Study on Acquisition, Use and Repayment Pattern of Kisan Credit Card Scheme in Himachal Pradesh

K.D. Sharma, Divya Sharma and Mahima Ghabru*

Department of Agricultural Economics, Extension Education, and Rural Sociology
College of Agriculture, CSK HPKV, Palampur-176 062 (HP)

**Corresponding author's email: kdsharma60@gmail.com*

Received: December 21, 2017 *Manuscript Number: NS-18-28* *Revision Accepted: February 12, 2018*

ABSTRACT

This micro-level study was conducted in Himachal Pradesh and is based on primary data collected from 50 Kisan Credit Card (KCC) beneficiary farmers (24 small, 13 medium and 13 large) and 30 non-KCC farmers selected randomly from 8 villages of Kangra district. The Kisan Credit Card (KCC) scheme has been initiated to simplify the procedure for acquisition and use of credit by the farmers and is expected to bring transformation in the rural credit structure and delivery mechanism. The average credit limit sanctioned for small, medium and large farms came out to be ₹21,792, ₹50,385 and ₹1,20,231, respectively and the average amount borrowed by these categories was ₹19,083, ₹45,885 and ₹99,615, respectively. The logistic analysis revealed that likelihood of adoption of KCC scheme significantly increased with the increase in the size of land holding and area under vegetable crops while higher education level and increase in family income reduced the probability of adoption. The probability of regular repayment was also significantly enhanced with the increase in area under vegetables and total family income. Based on the findings of the study, the scheme was found to fulfill social welfare objective favouring the resource-poor farmers. However, need was expressed by the farmers for revising their credit limits keeping in view the rising input prices and to consider other factors besides land holding like the area under commercial crops, possession of dairy/sheep/goat herds and farm enterprises.

Keywords

Adoption, credit limit, Kisan Credit Card, logistic analysis, repayment.

JEL Codes

G21, C01.

INTRODUCTION

Several policy initiatives have been taken for reforming the rural credit delivery system since mid-sixties for providing credit at the lower rate of interest to support the agrarian community in India. The impetus of these policies has always been to provide timely and adequate credit for improving the agricultural production and income of resource-poor farmers. Earlier credit delivery system did not provide for meeting other needs such as the purchase of feed and medicines for livestock, maintenance of machinery and unforeseen expenditure in crop loan that may arise in day to day life of a farmer. So to fulfill these undetermined expenditures and events, farmers had to take help of non-institutional credit delivery system to borrow at the exorbitant rate of interest (Nahatkar *et al.* 2002; Rao, 2003). In this endeavor, Kisan Credit Card Scheme (KCC) initiated in 1998 is one such policy initiative to provide adequate credit support to farmers in a flexible, hassle-free and cost-effective manner (Nahatkar *et al.*, 2002). Under this scheme, the credit limit is fixed on the basis of operational land holding, cropping pattern, and scale of finance. Entire production credit needs for a full year plus ancillary activities related to crop production are considered while fixing the limit. The card is valid for five years subject to annual review.

The KCC scheme intends to reduce paperwork through simplification of procedure for documentation in the bank (Sirisha & Malpadri, 2011). Each withdrawal is to be repaid within a maximum period of twelve months. Farmers have been receiving crop loans up to a principal amount of ₹3 lakh at 7 percent rate of interest since 2006-

07. In 2009-10, the government provided an additional 1 percent interest subvention to those farmers who repaid their short-term crop loans as per schedule. This subvention was raised to 2 percent in 2010-11 and further to 3 percent in 2011-12. Thus, presently the effective rate of interest for such farmers is 4 percent per annum. KCC scheme has been accepted both by bankers as well as farmers and is rated an innovative, widely accepted, highly appreciated and non-discriminatory credit delivery system (Hooda, 2011; Basha, 2013). Thus, the scheme needs to be extended to all sections including landless labourers, women entrepreneurs and weaker sections (Bista *et al.,* 2012; Kumar, 2013)

The KCC scheme was introduced in Himachal Pradesh during August 1998. There are 2061 branches of different banks implementing this scheme and till December 2016, as many as 7.14 lakh KCCs have been issued to farmers in Himachal Pradesh (Directorate of Economics and Statistics, 2017). It is expected that KCC scheme would achieve the desired objectives and bring spectacular transformation in the rural credit structure and delivery mechanism. This paper is based on a micro level study conducted in the hill state of Himachal Pradesh to examine the acquisition, use and repayment pattern of Kisan credit cards and suggests measures for further reforms to beneficiary farmers.

DATA AND METHODOLOGY

The study was carried out in Kangra district of Himachal Pradesh and two-stage sampling design was employed for the selection of eight villages and 50 sample farmers from a development block having a maximum number of KCC holders. Based on the credit limit, the KCC holders were post-stratified into three categories by using cumulative cube root frequency method and finally, a sample of 50 KCC holders (24 small, 13 medium and 13 large) and 30 non-KCC farmers were selected through proportional allocation method. Primary data were gathered by survey method.

A logistic model was used to find out factors affecting the probability of adoption and repayment of credit availed by KCC holders. The specific form of the model is:

$$P_i \quad E(Y_i \quad 1|Xk_i) \quad \frac{1}{1 \quad e^{zi}} \quad \frac{e^{zi}}{1 \quad e^{zi}}$$

where, $z_i = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \ldots + \beta_k X_k + u$

$$Odds\ ratio\ L_i \quad \frac{P_i}{1 \quad P_i}$$

The fitted form of the model was:

$$Logot\ [L_i] \quad L_n \frac{P_i}{1 \quad P_i} \quad {}_0 \quad {}_1 X_1 \quad {}_2 X_2$$

where, ${}_3 X_3 \quad {}_4 X_4 \quad \ldots \quad {}_k X_k \quad u$

P_i = Probability of adoption/ regular repayment by i^{th} farmer

Y_i = Dependent binary variable, that is, adopter/ regular repayment (Yes=1, No=0)

Z_i = Unobserved response for i^{th} farmer

X_k = explanatory variables viz., age of farmer (years), education (years), family size (no.), total land holding (kanals), area under vegetable (kanals), total annual income ('000 ₹)

β_o = Intercept

β_k =Regression coefficient associated with k^{th} variable

u = Random term

Impact of a unit change in an explanatory variable on probability was obtained by estimating marginal effect and elasticity coefficientsas:. To know the goodness of fit of the model, the Mcfadden R^2, and Chow R^2 was computed as follows:

Mcfadden R^2, = 1 – L (β)/L(0)

Where,

L (β) = Odds ratio with variables

L(0) = Odds ratio without variables

$$Chow\ R^2 \quad 1 \quad \frac{{}_{t\ 1}^{N}(z_i \quad \hat{z}_i)^2}{{}_{t\ 1}^{N}(z_i \quad \hat{z})^2}$$

The significance of R^2 was tested with the help of F-statistics as follows:

$$F_{\overline{2}} \quad (k \quad 1)(n \quad k)d.f. \quad \frac{R^2/(k \quad 1)}{(1 \quad R^2)/(n \quad k)}$$

where,

n = Number of sample observation used in the model

k = Number of parameters estimated from the sample

RESULTS AND DISCUSSION

Factors Affecting Adoption of KCC Scheme

The logical relationship between the adopters/non-adopters and different type of socio-economic variables expected to affect adoption of the scheme was studied. The specified variables are; education level, total land holding, the area under vegetables and total household income. The perusal of Table 1 shows that the probability of adoption of KCC scheme was enhanced significantly with the increase in the size of land holding and area under vegetable crops. However, as the education level increased the probability to adopt KCC scheme decreased significantly. The effect of total family income though non-significant was also found to decrease the probability of adoption of KCC scheme. This might be due to the fact that the educated and well to do families could meet their financial requirements of seasonal crops from their own savings. Moreover, the credit limit was also meager for them to utilize for substantial investment on machinery

for which they were acquiring term loans. The odds ratio with respect to coefficients also revealed that farmers having larger land holding and more area under vegetable crops were more likely to avail the KCC scheme while educated farmers with larger family income were less likely to adopt the same. The fitted logistic model also passed the test of 'goodness of fit' as revealed by the significance of Mcfadden and Chow R^2explaining 45 to 51 percent of the variation in adopting the scheme.

Acquisition and Use of KCC Loans

The study indicated that overall credit limit sanctioned through KCC scheme was ₹54,820 ranging from small, medium and large farms between₹21,792 for small, ₹50,385 for medium and ₹1,20,231 for large farmers (Table 2). The banks were adopting flexible/liberal approach regarding monitoring the end

Table 1. Estimates of logistic model for adoption of KCC scheme

Variables	Estimated coefficients (β)	Standard error	Odds ratio (EXP (β))
Constant	-1.9445	1.7269	-
Education (years)	-0.2866***	0.0907	0.7508
Total land holding (kanal)	0.7034***	0.1775	2.0206
Area under vegetables (kanal)	0.4173**	0.1849	1.5178
Total family income (₹ in thousand)	-0.0059	0.0039	0.9941
Statistical coefficients	Mcfadden R^2	Chow R^2	
	0.4493*	0.5127*	

**** and ** Significant at 1 and 5 percent level.*

Table 2. Utilization of KCC funds

(₹/farm)

Particulars	Small	Medium	Large	Overall
Average limit sanctioned	21792	50385	120231	54820
Productive use of loan borrowed				
Seed	929	923	1192	996
	(4.86)	(2.01)	(1.20)	(2.12)
Fertilizer	550	615	731	614
	(2.88)	(1.34)	(0.73)	(1.31)
Cattle Feed	562	1000	7463	2470
	(2.95)	(2.18)	(7.49)	(5.26)
Labour payment	625	539	846	660
	(3.28)	(1.17)	(0.85)	(1.41)
Plant protection	592	693	808	674
	(3.10)	(1.51)	(0.81)	(1.43)
Purchase of tools/machinery for farm	771	1192	11307	3620
	(4.04)	(2.60)	(11.35)	(7.70)
Repair of farm building/stores/cattle shed	3521	10846	16692	8850
	(18.45)	(23.64)	(16.76)	(18.83)
Sub-total	7550	15808	39039	17884
	(39.56)	(34.45)	(39.19)	(38.06)
Non-productive use of loan borrowed				
Own consumption	4492	6808	10500	6656
	(23.54)	(14.84)	(10.54)	(14.17)
Social ceremony	4500	14193	27461	12990
	(23.58)	(30.93)	(27.57)	(27.64)
Education	2541	9076	22615	9460
	(13.32)	(19.78)	(22.70)	(20.13)
Sub-total	11533	30077	60576	29106
	(60.44)	(65.55)	(60.81)	(61.94)
Average amount borrowed	19083	45885	99615	46990
	(100.00)	(100.00)	(100.00)	(100.00)

Figures in parentheses indicate percentages to the average amount borrowed in each category.

user and not insisting on documentary proofs of purchase of inputs etc. The observations from the field indicated that all the farmers had used the major proportion of loan borrowed for financing their own expenses and family requirements. Just about 38 percent (under KCC was used for production purpose viz., repair of farm buildings/store/cattle sheds (18.83 percent), purchasing/hiring tools, implements and machinery (7.70 percent), buying seeds (2.12 percent), purchasing fertilizers (1.31 percent) and buying feed for cattle (5.26 percent). The amount used for non-production (consumption) purposes was substantial that included buying of household items/ consumer durables or clothing, food items, paying education expenses, medical expenses, meeting expenses of social ceremonies.

The comparison across different categories revealed that small farmers used a relatively higher proportion for the purchase of agricultural inputs, medium category utilized for repairs of buildings and meeting social ceremonies while large farmers used a higher proportion for the purchase of implements and machinery.

Factors Influencing the Repayment of KCC Loan

The perusal of Table 3 shows the category-wise amount borrowed and repaid by KCC beneficiaries. In case of small farms, the amount repaid was ₹7,735 that accounted for 40.53 percent of the total amount borrowed by them and the outstanding amount was ₹12,307. The repayment was to the extent of 42.31 percent on medium and 41.49 percent on large farms. The overall amount outstanding was ₹29,625 per farm while the overall repayment came out to be 41.51 percent. The results clearly reveal that the repayment pattern was almost same on different categories. The farmers were using KCC account as a saving bank account which is the most striking feature of this scheme for the benefit of poor farmers.

Table 4 further shows the factors affecting repayment behaviour of KCC farmers. The variables like the area under vegetable crops and family income had a positive and significant influence on the loan repayment while the factors like age and family size had a negative relationship though of non-significant nature. The magnitude of change in the probability of regular repayment was mainly through the area under vegetables (0.0380) and total family income (0.0008). The elasticity at mean revealed corresponding percentage change in the probability of repayment with one percent change in explanatory variables under consideration. The significant value of R^2 shows that the explanatory variables explained 48 to 50 percent of the variations in probability of regular repayment of the loan.

CONCLUSIONS

The study clearly puts forth that KCC scheme has benefitted the farmers in availing credit at the low rate of interest. Although the use of credit was less for the productive agricultural activities but, it was meeting the contingency family needs of resource-poor farmers who could use KCC as saving bank account. Therefore, more efforts should be made by the banks to reach out to all the farmers. It was observed that the KCC scheme has been adopted more by the vegetable growers who are also found regular in repayment of the loan. This clearly shows

Table 3. Category-wise amount borrowed, repaid and outstanding on sample KCC farms

(₹per farm)

Size of farm	Amount borrowed	Amount repaid	Amount outstanding*	Amount repaid (Percent)
Small	19083	7735	12307	40.53
Medium	45885	19412	28632	42.31
Large	99615	41335	62588	41.49
Overall	46990	19507	29625	41.51

**Amount outstanding includes principal and interest charged.*

Table 4. Estimates of logistic model for repayment of KCC loan

Variable name	Mean of variable	Estimated coefficients	Standard error	Marginal effect	Elasticity at mean
Constant	-	2.8736	6.8969	-	0.0898
Age (years)	54.46	-0.0430	0.0580	-0.0013	-0.0732
Area under vegetables (kanal)	2.44	1.2547**	0.5184	0.0380	0.0959
Family size (No.)	5.34	-1.4298	1.0035	-0.0433	-0.2387
Total family income (₹ thousand)	280.21	0.0267**	0.0112	0.0008	0.2335

Statistical coefficients	Mcfadden R^2	Chow R^2
	0.4952***	0.4784***

**** and ** Significant at 1 and 5 percent level.*

the positive impact of the scheme in promoting diversification through commercialization of agriculture with vegetable crops. The scheme should be extended to all the cultivators, landless farmers, agricultural labourers and rural artisans. The credit limits of the KCC farmers need to be revised every year keeping in view the increase in input prices. Besides landholding, possession of dairy/sheep/goat herds and farm enterprises should also be taken into consideration while determining credit limit so that landless labourers, rural artisans, and women entrepreneurs can also avail the credit under KCC scheme.

REFERENCES

Basha, G.A. (2013). Kisan Credit Card-A gift to agriculture. *Intercontinental Journal of Finance Resource Research Review, 1,* 22-25.

Bista, D.R., Kumar, P., & Mathur, V.C. (2012). Progress and performance of Kisan Credit Card Scheme with a case study of Bihar. *Agricultural Economics Research Review,* ***25,***125-135.

Directorate of Economics and Statistics. (2017). *Economic survey of Himachal Pradesh*. Directorate of Economics and Statistics. Shimla: Government of Himachal Pradesh.

Hooda, V.S. (2011). Kisan Credit Card Scheme: A success story. *Kurukshetra, 59,* 19-22.

Kumar, C. (2013). Agricultural credit and indebtedness: A case study of Kisan Credit Card (KCC) in Rampur block of Kaimur district in Bihar. *International Journal of Retailing and Rural Business Perspectives*, ***2***, 314-318.

Nahatkar, S.B., Mishra, P.K., Raghuvanshi, N.K., & Beohar, B.B. (2002). An evaluation of Kisan Credit Card scheme: A case study of Patan tehsil of Jabalpur district of Madhya Pradesh. *Indian Journal of Agricultural Economics 57,* 578-579.

Rao, C.H. (2003). Reforms agenda for agriculture. *Economic and Political Weekly, 38,*615-620

Sirisha, S., & Malpadri, D. (2011). Kisan Credit Card (KCC): A vehicle for financial inclusion. *International Journal of Marketing and Technology, 1,* 46-53

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 282-286
DOI: 10.5958/2322-0430.2018.00072.0

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Trend of Capital Formation in Agriculture: Hadoti Region of Rajasthan

Pradeep Joliya[1], V. Kamalvanshi[2], Saket Kushwaha[2] and Shilpi[2]*

[1]*ICAR- National Institute of Agricultural Economics and Policy Research, New Delhi-110012*
[2]*Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi- 221005*

[*]*Corresponding author's email: pjoliya@gmail.com*

Received: December 03, 2017 *Manuscript Number: NS-18-33* *Revision Accepted: February 13, 2018*

ABSTRACT

The present study was analysis the trend of capital formation in agriculture. Data was collected from 1963 to 2012 and 2002-03 to 2013-14 for different assets. Exponential growth model was used for the analysis of trend. Result revealed that in case of livestock overall growth of Hadoti region was 0.6 percent; a buffalo (2.4 percent) shows the increasing trend while in case of cattle (-0.5 percent) there is negative trend. In the case of machinery equipment tractors (10.9 percent) and sugarcane (0.7 percent) shows the positive growth and carts (-0.8 percent), plough (-0.8), Ghanies (-2.7 percent) shows the negative growth in Hadoti region. In case of irrigation structure and equipment tube well and electric pump shows the positive trend while diesel pump and well in use shows the negative trend in Hadoti region.

Keywords
Capital, equipment, growth, livestock, machinery, trend

JEL Codes
O13, Q10, Q15, Q16, Q21.

INTRODUCTION

The concept of agricultural development is very crucial in the context of the Indian economy, where even sub-marginal land has been brought under cultivation and labor is still easily available. Modernization of agriculture just a word but covers up a large parameter of new technological advances for a better productivity using these tools. This, in turn, calls for a constant growth of capital. The larger the portion of current output invested in capital assets by the cultivating families the greater would be the increase in production and the rate of growth (Murukannaiah, 2006). A broad definition of capital would include, besides physical durable assets, the circulating working capital and the human resources in organizing the economic activity. However, the study of capital formation includes only those tangible assets which can be used for further production in which, it has characteristics such as facility of transferring stock into flow services, facility of transferring stock into income over time and improving productivity over time (Yadav, 2002). Hooley (1967) estimated that capital formation are presently prepared in many underdeveloped countries are likely to produce results which contains conceptual basis, usually downward. More specifically, there tend to be underestimations of capital formation in agriculture, in inventory accumulation, in the traditional trading sectors, and in some types of fixed assets. Mishra & Chand (1995) argue the behavior of public and private capital formation in agriculture and also examine the efficiency of capital use in agriculture. They conclude that the efficiency of capital use in Indian Five Year agriculture shows continuous improvement since the 7 Plan.

The growth rate of Indian economy depends more on capital formation in agriculture, industry and service sectors than only on wishful thinking. The government has set the target of GDP growth at 8 percent per annum for the 10 plan period and within this overall growth, the target of agriculture growth has been fixed at 4 percent. It is not possible to achieve this target. But it would not materialize unless capital formation in the farm sector increases up to about 15 percent of its contribution to the GDP. In recent years, capital formation in the farm sector has not been even half of this (Singh, 2001). The performance of the agriculture sector influences the

growth of the Indian economy. The growth of agriculture and allied sectors is still a critical factor in the overall performance of the Indian economy. As against the Twelfth Five Year Plan's (2012-17) target of 4 percent growth for the agriculture and allied sectors, the growth registered was 4.2 percent in 2013-14,-0.2 percent in 2014-15 (Economic Survey, 2015). The Gross Capital Formation (GCF) in agriculture and allied sectors as a proportion to the Gross Domestic Product (GDP) in the sector stagnated around 14 percent during 2004-05 to 2006-07 the again from 2007-08 to 2009-10 it showed a great marked movement from 16.1 percent to 20.1 percent and a downfall in 2010-11 of 18.5 percent. Now again coming up to 2011-12 to 2013-14 it has shown a decreasing trend of 18.3 percent to 15.1percent. However, there is a marked improvement in this figure during the five-year plans (Economic Survey, 2014). There is a need to significantly step up investment in agriculture, both by the private and public sectors to ensure sustained target growth 4 percent per annum. Agricultural development has many facets- technical, organizational, financial, demographic, sociological and capital formation.

METHODOLOGY

Source and Period of Data

The study was based on secondary data. Secondary data was collected from period of period 1963-2012 for livestock 1963 to 2012, implement and machinery 1963 to 2012 and for irrigation structure and equipment 2002-03 to 2013-14. Data were collected from different sources like soil conservation officers, block development officer and respective village development officers, district statistical officer, district agriculture officer, Directorate of Economics& Statistics.

Analytical Tool

Exponential growth model was used for the analysis and the model will take following form.

$Y = ab^t$

Where

Y= Dependent variable (Land improvement, Livestock, Purchase of implements, Machine and transport equipment, these are the variable will be used) for which the growth rate will be estimated

a= Intercept

b= Regression coefficient

t= Time period

The compound growth rate will be obtained from the logarithmic form of the equation (1) as below

$\ln y = \ln a + t \ln b$

The percent compound growth rate (g) will be derived using the relationship

$g = (\text{Anti ln of } b - 1) \times 100$

RESULTS AND DISCUSSION

Growth Rate of Livestock

The growth rates of livestock in Hadoti Region of Rajasthan were estimated using the data from 1961 to 2012 with the help of the Exponential Model and presented in Table 1.

Livestock of any states plays a crucial role in its

Table 1. Compound growth rates of livestock in Hadoti Region from 1961 to 2012

Particulars	Cattle	Buffalo	Sheep	Goat	Horse	Camel	Pig	Total
Kota+Baran District								
SE	0.001	0.002	0.003	0.003	0.005	0.005	0.013	0.064
F. Value	4.802	209.22***	12.52***	10.322**	104.986***	2.917	3.681*	20.903***
R^2	0.348	0.959	0.582	0.534	0.921	0.007	0.29	0.699
CGR (percent)	-0.4***	2.5***	-1.00***	1.00***	-5.7***	-1.2***	2.5***	0.5***
Bundi District								
SE	0.003	0.002	0.01	0.003	0.006	0.008	0.012	0.001
F. Value	3.923*	293.903***	0.805***	6.704**	6.235**	0.353	5.675**	26.139***
R^2	0.364	0.967	0.0825	0.427	0.409	0.038	0.387	0.744
CGR (percent)	-0.5***	3.3***	-0.9***	0.7***	-1.5***	0.25***	2.7***	0.6***
Jhalawar District								
SE	0.001	0.001	0.003	0.003	0.003	0.011	0.02	0.001
F. Value	4.422*	189.084***	27.192***	19.83***	143.9***	5.365**	0.348	28.782***
R^2	0.329	955	0.751	0.688	0.941	0.373	0.037	0.762
CGR (percent)	-0.3***	1.3***	-1.5***	1.2***	-3.7***	-6.5***	1.1***	0.5***
Hadoti Region								
SE	0.002	0.002	0.004	0.002	0.004	0.005	0.013	0.001
F. Value	5.076***	624.481***	5.436***	16.41***	106.301***	2.086	3.371	33.467***
R^2	0.361	0.967	0.307	0.606	0.922	0.188	0.272	0.788
CGR (percent)	-0.4***	2.4***	-1.00***	0.9***	-3.9***	-0.8***	2.4***	0.6***

******, **, * indicates significance level at 1, 5, and 10 percent.***
CGR: Compound Growth Rate (percent per annum).
SE: Standard Errors.

multifaceted development. Region rich in its livestock would be rich in health of its people which is also a form of capital formation. Livestock in the study area composed of cow, buffalo, sheep, goat, horse, camel, and pig. During this period in Hadoti Region the total livestock registering a compound annual growth rate of 0.6 percent over the entire study period. It is further observed that during the same period district Kota and Baran registered an increased by 0.5 percent, in Bundi district the annual compound growth rate was registered also an increases of 0.6 percent whereas Jhalawar district registered compound annual growth rate of 0.5 percent.

In Kota and Baran district amongst different components of livestock, buffaloes and pigs registered the highest growth (2.5 percent), followed by goat (1.00 percent), while negative growth was observed in the case of horse (-5.7 percent), camels (-1.2 percent), sheep (-1.00 percent) and cattle (-0.4 percent). In Bundi district amongst different components of livestock, buffaloes registered the highest growth (3.3 percent), followed by pigs (2.7 percent), goat (0.7 percent) and camel (0.25 percent) while negative growth was observed in the case of horse (-1.5 percent), sheep (-0.9 percent) and cattle (-0.5 percent). In Jhalawar district amongst different components of livestock, buffaloes registered the highest growth (1.3 percent), followed by goats (1.3 percent), and pig (0.7 percent) while negative growth was observed in the case of camel (-6.5 percent), horse (-3.7 percent), sheep (-1.5 percent) and cattle (-0.5 percent).

In overall Hadoti Region amongst different components of livestock, buffaloes and pig registered the highest growth (2.4 percent), followed by goats (0.9 percent) while negative growth was observed in the case of horse (-3.9 percent), sheep (-1.00 percent), camel (-0.8 percent), sheep and cattle (-0.5 percent).

The above finding is in line with the finding of Singh (2014) who reported that (during 1956-2007) there is an increases in the numbers of buffalos, sheep and goats by 264.23 percent, 17.7 percent, and 286.58 percent respectively while cow population has increased only 12.60 percent in Rajasthan. This also support the findings of Murukannaiah (2006) where he reported that among different livestock components, cattle accounted for the highest proportion (20.79 percent) of the 5.2 crore animal stock in the State, followed by sheep (15.36 percent), goat (9.36 percent), buffaloes (8.38 percent) and dogs (4.11 percent). Pigs, donkeys, horse and ponies, mules, camels and other livestock accounted for less than one percent of the total livestock in the State. The high growth rate of buffalo and goats are also registered in Hadoti Region but decline in case of cattle which contradict the finding of Singh (2014); Murukannaiah (2006). Singh (2014) further emphasized that exotic breeds are replacing the indigenous breeds. This might be the reason of high milk production in Rajasthan with fewer numbers of cattle which led towards negative growth in case of Cattle in Hadoti Region.

Growth Rate of Machinery and Equipment

The growth rates of Machinery and equipment in Hadoti Region of Rajasthan were estimated using the data from 1961 to 2012 with the help of the Exponential Model and presented in Table 2. The growth in capital formation was also analyzed in terms of physical units of agricultural capital assets, such as ploughs, carts, sugarcane crushers, tractors, and Ghanies.

In Kota and Baran district the annual compound growth rate for the period, 1961 to 2012 was 11.7 percent in case of tractors while growth rate was registered negatively for plough (-4.3 percent), carts (-11.9 percent), sugarcane crushers (-4.8 percent)a and Ghanies (-3.9 percent). In Bundi district the annual compound growth rate for the period 1961 to 2012 was registered positive 9.4 percent in case of tractors and sugarcane crushers (6 percent) while growth rate was registered negatively for plough (-1.2 percent), carts (-0.4 percent),) and Ghanies (-0.2 percent). In Jhalawar district the annual compound growth rate for the period 1961 to 2012 was registered positive 15.4 percent in case of tractor and carts (0.1 percent) while growth rate was registered negatively for plough (-0.8 percent), sugarcane crushers (-3.1 percent) and Ghanies (-0.2 percent). In Hadoti Region the annual compound growth rate for the period 1961 to 2012 was registered positive 10.9 percent in case of tractor which was highest followed by Sugarcane crushers (0.7 percent) while growth rate was registered negatively for plough (-0.8 percent), carts (-0.8 percent) and Ghanies (-2.7 percent).

The finding of the current study support the finding of Murukannaiah (2006) in which he reported that the major agricultural implements and machinery put together in Karnataka were of the order of 39.06 lakhs during 1977 census which increased to 49.19 lakhs during 1997 Census, thus registering a growth of 25.92 percent. In Hadoti region the tendency of mechanized farming is increasing because of the fact that cropping intensity quite high 206.66 percent.

Compound Growth Rate of Irrigation Structure and Equipment

The growth rates of irrigation structure and equipment in Hadoti Region of Rajasthan were estimated using the data from 2002-03 to 2013-14 with the help of the Exponential Model and presented in Table 3.

Irrigation structure and equipment of any states plays a crucial role in its multifaceted development and leads towards high cropping intensity. Hadoti Region is rich in its Irrigation structure and equipment would be rich in health of its farm which is also a form of capital formation. Irrigation structure and equipment in the study area composed of diesel pump, electric pump, tubewell and well in use. During this period in Kota district highest positive compound annual growth rate was observed for tubewell (11.8 percent) followed by electric pump (5.00 percent) and negative compound annual growth rate was found in case of diesel pump (-8.3 percent) while it was -

Table 2. Compound growth rates of machinery and equipment in Hadoti Region from 1961 to 2012

Particulars	Plough	Carts	Sugarcane crushers	Tractors	Ghanies
Kota+Baran District					
SE	0.007	0.011	0.011	0.01	0.015
F. Value	38.656***	2.681	18.869***	139.619***	6.196**
R^2	0.866	0.309	0.759	0.426	0.959
CGR (percent)	-4.3***	-11.9***	-4.8***	11.7***	-3.9***
Bundi District					
SE	0.005	0.004	0.051	0.007	0.037
F. Value	5.165*	4.922**	1.502	188.196***	0.004
R^2	0.463	0.451	0.2	0.968	0.001
CGR (percent)	-1.2***	-0.4***	6***	9.4***	-0.2***
Jhalawar District					
SE	0.003	0.002	0.019	0.025	0.007
F. Value	6.610**	0.360	2.667	42.449***	27.248***
R^2	0.524	0.057	0.308	0.876	0.82
CGR (percent)	-0.8***	0.1***	-3.1***	15.4***	-3.7***
Hadoti Region					
SE	0.006	0.004	0.025	0.013	0.008
F. Value	6.849**	4.317*	0.79	75.49***	10.526**
R^2	0.553	0.418	0.013	0.926	0.973
CGR (percent)	-1.5***	-0.8*	0.7***	10.9***	-2.7***

******, **, * indicates significance level at 1, 5, and 10 percent.***
CGR: Compound Growth Rate (percent per annum).
SE: Standard Errors.

Table 3. Compound growth rate of irrigation structure and equipment in Hadoti Region from 2002-03 to 2013-14

Particulars	Diesel pump	Electric pump	Tubewell	Well in use
Kota District				
SE	0.011	0.009	0.008***	0.01
F. Value	53.01***	33.755***	232.897	61.078***
R^2	0.844	0.772	0.959	0.884
CGR (percent)	-8.3***	5.0***	11.8***	-8.2***
Baran District				
SE	0.003	0.008	0.014	0.003***
F. Value	14.974***	126.681***	140.536***	40.065
R^2	0.6	0.927	0.934	0.834
CGR (percent)	-1.3***	8.2***	15.9***	-2.1***
Bundi District				
SE	0.008	0.012	0.012	0.002
F. Value	31.506***	7.369**	97.673***	78.771***
R^2	0.759	0.424	0.909	0.908
CGR (percent)	-4.8***	3.2***	11.2***	-2.1***
Jhalawar District				
SE	0.005	0.025	0.018	0.007
F. Value	2.016***	1.517	42.69***	116.37***
R^2	0.168	0.132	0.81	1.009
CGR (percent)	0.8***	3.11***	11.1***	0.9***
Hadoti Region				
SE	0.005	0.007	0.009	0.008
F. Value	12.591***	58.474***	249.071***	76.004***
R^2	0.557	0.854	0.961	0.905
CGR (percent)	-1.7***	4.9***	13.0***	-1.0***

******, **, * indicates significance level at 1, 5, and 10 percent; CGR: Compound Growth Rate (percent per annum); SE: Standard Errors.***

8.2 percent for well in use. In Baran district highest positive compound annual growth rate was observed for tubewell (15.9 percent) followed by electric pump (8.2 percent) and negative compound annual growth rate was found in case of diesel pump (-1.3 percent) while it was -2.1 percent for well in use.

In Jhalawar district highest shows the positive compound annual growth rate was observed for tubewell (11.1 percent) followed by electric pump (3.11 percent), diesel pump (0.8 percent) and well in use 0.9 percent). In Overall Hadoti Region, highest positive compound annual growth rate was observed for tubewell (13.0 percent) followed by electric pump (4.9 percent) and negative compound annual growth rate was found in case of diesel pump (-1.7 percent) and well in use (-1.0 percent).

Finding of the current research is in line with the findings of Singh (2014) where he reported that the growth in the number of oil-engines and electric pump-sets is far more impressive than that of tractors. The number of oil engines increased from 1.95 to 4.27 lakh from 1983 to 2003. During this period the availability of these equipments per lakh of gross cropped area increased from 151 to 2,035 and131 to 2,892 respectively. With the increased efforts towards intensive farming coupled with high cropping intensity, the emphasis on irrigation increased many folds. The irrigated area by all sources was only 9.3 percent in 1951 has increased by about 45 percent in 2004-05 out of the total potentiality (53 percent) of irrigation in the arid region of Rajasthan which was highest in Hadoti region. This expansion of irrigation has resulted inclusion of new lands which were earlier under fallow lands, pastures and grazing lands, thus causing shrinkage in pastures and grazing lands of 0.6 percent over the entire study period. It is further observed that during the same period district Kota and Baran registered an increased by 0.5 percent, in Bundi district the annual compound growth rate was registered also an increases of 0.6 percent whereas Jhalawar district registered compound annual growth rate of 0.5 percent.

CONCLUSIONS

The trend of investment on capital formation in agricultural sectors in Hadoti region is showing increasing trend on progressive technologies, like machinery and equipments, electric pumps and tube wells as well as on sturdy milch animals while it is showing decreasing trend in case of plough, carts, diesel pumps and open wells. The capital formation has taken place more in productive assets such as farm equipments and machinery, irrigation equipment and maintenance of irrigation structure. Progressiveness of agriculture contributes to the faster capital formation. The policymakers need to concentrate their efforts to increase the area under irrigation, liberalizing credit directed towards formation of productive assets and producing the cheap equipments and providing subsidy, commercialization of agriculture and better extension efforts so that capital formation in agriculture takes place at a faster rate leading to the speedy development of agriculture.

REFERENCES

Economic Survey. (2015; 2016). *Economic survey*. Ministry of Finance, Government of India, New Delhi.

Hooley, R.W. (1967). The measurement of capital formation in underdeveloped countries, *The Review of Economics and Statistics*, *49*(2), 199-208.

Mishra, S.N., & Chand, R. (1995). Public and private capital formation in Indian agriculture: Comments on the complementarity hypothesis and others. *Economic and Political Weekly*, *30*(25), A64-A79.

Murukannaiah, S. (2006). *Capital formation in agriculture in Chitradurga district of Karnataka state an economic analysis* (Master's Thesis). University of Agricultural Sciences, Dharwad.

Singh, B.P. (2001, August 16). Lopsided economic reforms. *The Hindu,* Chennai.

Singh, J.B. (2014). Spatio-temporal changes of livestock in the arid region of Rajasthan *Asian Resonance, 4*(3), 124-129.

Yadav, A.K.S. (2002). *Capital formation in agriculture in Bahirich district* (Doctoral Thesis)**.** Banaras Hindu University, Varanasi.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 287-296
DOI: 10.5958/2322-0430.2018.00073.2

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Non-Farm Employment and Implication on Agriculture Sector in Rural India

Prem Chand, Sulakshana Rao, S.P. Subash and L. Malangmeih*

ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi-110012

**Corresponding author's email: gowripriyarao@gmail.com*

Received: December 31, 2018 *Manuscript Number: NS-18-63* *Revision Accepted: February 28, 2018*

ABSTRACT

Indian economy has been witnessing a transformation in its occupational structure since the past few decades. There is an increase in rural non-farm employment along with a decline in the agricultural employment. The present study analyzed the trends, patterns, and distribution of rural workforce in rural India using different rounds of Employment and Unemployment Survey data by NSSO. We explored various dimensions such as farm size, education, skill, gender and regions and its implication on agricultural sector. The study shows that the non-farm employment in rural India was gaining momentum due to the growth in economy resulting in economic diversification. Agriculturally forward states like Himachal Pradesh, Punjab, Madhya Pradesh, had shown a stupendous increase in non-farm employment from 1993 to 2015. Gender disaggregated employment of workforce reveals that the rate of increase in non-farm employment among male workers in rural India is much higher than their female counterparts. Casualization of labour was also highest in female workers. While landless and marginal rural workforce was shifting to non-farm employment, the medium and large farmers were still dependent on agriculture for occupation. It was also observed that educated and skilled workforce in agriculture and moving out to non-farm sector. The study reveals that these transformations are bringing newer challenges to agricultural sector.

Keywords
Rural economy, non-farm employment, casualization of labour.

JEL Codes
E24, O13, O18.

INTRODUCTION

Agriculture is an integral part of an economy as it is closely linked to the global food system. Nevertheless, it is also the most aggressively managed ecosystem, in order to meet the needs of the rising population. In rural economies like India, agriculture has been the central plank of development and employment in the rural economy. However, the increased dependence on agriculture has led to compromised sustainability. Indian economy has been witnessing a transformation in its occupational structure since the past few decades. In the recent years, the share of agriculture and allied activities in Gross Domestic Product (GDP) as well as in the share of employment has declined (Venkatesh, 2013; Eswaran *et al.,* 2009). Statistics reveal that the rural non-farm employment has been increasing at a significant rate since the same period. Various studies validate that the share of non-farm employment in rural workforce is improving across the country (Reddy, 2015; Ranjan, 2007; Jha, 2006; Sinha, 2007; Kashyap & Mehta 2007; Kundu *et al.,* 2003, Reddy *et al*., 2014). The increase in rural non-farm employment along with a decline in the agricultural employment indicates that the agricultural sector would be insufficient to overcome the major problems of poverty and unemployment. Hence, in the long run, developing countries like India should diversify its economy and reduce its dependence on agriculture for a steady and stable economic growth as well for sustained growth in agriculture. One possible alternative which is gaining policy significance in the span is the expanding network of non-farm employment.

The importance of non-farm employment in rural India is gaining momentum mainly because of two reasons. One, the labour absorptive capacity of agriculture in India is saturated as indicated by the declining marginal productivity of labour. Two, non-farm

employment promises a stable income to rural household unlike the intra and inter-year fluctuation in agricultural income. However, its implication on agriculture is necessary to be addressed. With this perspective, the present study analyses the trends, patterns, and distribution of rural workforce in rural non-farm employment. The pattern in non-farm employment according to various dimensions such as farm size, education, skill, gender, and regions would also be studied and the implication on agricultural sector is explored.

METHODOLOGY

This paper is entirely based on the findings from National Sample Survey data from various reports of previous rounds (Employment and Unemployment Situation in India-50thRound (July 1993-June 1994), 55th round (July 1999-June 2000), 61st Round (July 2004-June 2005) and 66th round (July 2009-June 2010) and unit level data of the last two rounds (61st and 66th).The performance of rural economy in terms of output and employment was studied during three distinct periods chosen on the basis of the major changes in the Indian economy during the past four decades. These periods are 1993-94, 1999-00, 2004-05, 2009-10, 2011-12.An analysis of extent of casualization in rural non-farm workforce has been carried out numerically and statistically. Numerical measures include calculation of compound annual growth rates, distribution of rural workers on the basis of employment status, index of casualization (measured as number of casual wage labourers per hundred regular employees) shown across the genders and social groups.

RESULTS AND DISCUSSION

A perusal of the sectoral distribution of rural workers (Table 1) reveals that though agriculture is the main work area in rural India, there has been a gradual decline of agricultural workers from 83.4 percent in 1970s to 58.9percent in 2015-16. In the same period, non- farm sectors like construction, trade, hotels and restaurants, transport and communication witnessed a steady incline in the rural workers. In the construction sector, the share of workers was 1.3 percent in the 1970s which rose to almost 5 percent in 2004-05, which almost doubled to 9.4 percent in 2009-10 reaching 12 percent in 2015-16. The main reason for this increase could be the economic diversification and the growth of the economy in general which is associated with a decline in the employment in agricultural sector and shift of workers to other sectors. The growth patterns in various sectors reveal sizeable diversification of the rural economy towards non-farm sectors. The employment data in successive NSSO rounds was analyzed to see if this pattern is reflected in employment scenario as well.

The perusal of Table 2 reveals that the rate of increase in non-farm employment among male workers in rural India is much higher than their female counterparts during 1977-78 to 2015-16. The percentage of male workers in agriculture and allied sector declined from 80.6 percent in 1977-78 to almost 60 percent in 2015-16. This decline was distributed across the non-farm sectors noticeably the secondary sector like construction and tertiary sector like trade and hotels as well as transportation. On the other hand, 71.6 percent of the female workers in rural India are still engaged as agriculture workers. The increase in the male workers category was steeper during the 2004-05 (4.9 percent) while in the female workers category the shift to non-farm sector was higher during the 2009-10 phases (3.9 percent). In case of the female rural workers, the shift to non-farm sector was mainly to construction, manufacturing and other sectors. The statistics reveal that the number of rural non-farm workers has increased tremendously during 2004-05 to 2009-10 phases especially in construction and other secondary as well as tertiary sectors. The increase in rural non-farm employment along with a decline in the agricultural employment indicates that the agricultural sector would be insufficient to overcome the major problems of poverty and unemployment.

Even though the trend of non-farm employment in

Table 1. Sectoral distribution of the workers in rural India: 1977-78 to 2015-16 (Rural persons)

	1977-78	1983-84	1987-88	1993-94	1999-00	2004-05	200-10	2011-12	2015-16
Agriculture and allied	83.4	81.5	78.3	78.4	76.3	72.7	67.9	64.1	58.9
Mining and quarrying	0.4	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.4
Manufacturing	6.2	6.8	7.2	7.0	7.4	8.1	7.2	8.6	7.8
Electricity, gas and water	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.4
Construction	1.3	1.6	3.3	2.4	3.3	4.9	9.4	11.1	11.9
Secondary sector	8.0	9.0	11.2	10.2	11.4	13.7	17.4	20.4	20.5
Trade, hotels and restaurants	3.3	3.4	4.0	4.3	5.1	6.1	6.4	6.7	7.9
Transport and communication	0.8	1.1	1.3	1.4	2.1	2.5	2.9	3.0	4.0
Other services	4.5	4.9	5.1	5.7	5.2	5.0	5.4	6.0	8.8
Tertiary sector	8.6	9.4	10.4	11.4	12.4	13.6	14.7	15.7	20.7
All	100	100	100	100	100	100	100	100	100

Source: Calculated based on various rounds of NSSO and 5th EUS of Labour Bureau of India.

Table 2. Sectoral distribution of across gender in rural India: 1977-78 to 2015-16

Particulars	Male									Female								
	77-78	**1983**	**87-88**	**93-94**	**99-00**	**04-05**	**09-10**	**11-12**	**15-16**	**77-78**	**1983**	**87-88**	**93-94**	**99-00**	**04-05**	**09-10**	**11-12**	**15-16**
Agriculture and allied	80.6	76.8	74.5	74.1	71.4	66.5	62.8	59.4	54.3	88.1	86.7	84.7	86.2	85.4	83.3	79.4	74.9	71.6
Mining and quarrying	0.5	0.6	0.7	0.7	0.6	0.6	0.8	0.5	0.4	0.2	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.2
Manufacturing	6.4	7.2	7.4	7.0	7.3	7.9	7.0	8.1	7.7	5.9	6.9	6.9	7.0	7.6	8.4	7.5	9.8	7.9
Electricity, gas and water	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Construction	1.7	2.6	3.7	3.2	4.5	6.8	11.3	13.0	13.6	0.6	0.9	2.7	0.9	1.1	1.5	5.2	6.6	7.2
Secondary sector	8.8	10.6	12.1	11.2	12.6	15.5	19.3	21.9	22.3	6.7	8.1	10.0	8.3	9.0	10.2	13.0	16.8	15.4
Trade, hotels and restaurants	4.0	4.4	5.1	5.5	6.8	8.3	8.2	8.0	9.5	2.0	2.1	2.1	2.1	2.0	2.5	2.8	3.0	3.6
Transport and communication	1.2	1.8	2.0	2.2	3.2	3.8	4.1	4.2	5.3	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.4
Other services	5.3	6.2	6.2	7.0	6.1	5.9	5.5	6.4	8.7	3.0	3.0	3.0	3.4	3.7	3.9	4.6	5.2	9.0
Tertiary sector	10.5	12.4	13.3	14.7	16.1	18.0	17.8	18.6	23.5	5.1	5.2	5.2	5.6	5.8	6.6	7.6	8.4	13.0
All	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Calculated based on various rounds of NSSO and 5th EUS of Labour Bureau of India.

rural India is on an inclining side, it is essential to understand if this development and employment generation in the non-farm sector is sustainable in the long term or not. This paper, therefore, analyses the casualization of labour across different groups and across gender. Also based on the level of education of rural workers (non-farm as well as the farm workers), the extent of casualization were also analyzed. Table 3 analyses the extent of casualization of labour among the different gender as well as in the rural workforce as whole. Analysis has been conducted on numerical basis such as distribution of rural workforce across the gender through employment percentage and through Index of Casualization of labour (shows the number of casual wage earners for every one hundred regular salaried employees). Among the rural males, the percentage of self-employed has decreased across the years, from 60.5 percent in 1983 to 50.4 percent in 2015-16. In general, self-employment is on a declining scale across the genders as well as rural workforce as a whole. The decline was highest (17 percent) among the rural female from 1983-2015. Casualization of labour was also highest in female workers in the rural India. In case of rural persons, among the total employees, 49.10 percent are self-employed; followed by 10.70 percent regular employee and remaining 40.30 percent are casual labourers. Out of the hundred regular salaried employees, 377 of the rural persons are casual wage earners. Considering the rural male category, out of the total employed persons, 50.4 percent are self-employed followed by 11.8 percent in regular employees and 37.7 percent as casual employed wage earners. Casualization of labour was highest among the female employee. During the 1980s, the casualization in female labour was 1261 which means for 100 regular employees, 1261 are casual wage earners among the rural female. Even though later these figures showed a declining trend, still, in 2015-16, the casualization of female workers are still higher than the rural male as well as the rural persons. In 2015-16, for 100 regular employed workers, there were 621 casual wage earners. Many studies reveal that casualization was resulted due to globalization and opening up of the economy (Chadha & Sahu, 2002; Sahu,, 2003; Chadha, 2002; Chatterjee & Kundu, 2002; Pais, 2002). Casualization of the rural workforce continued to rise significantly during the post-economic reform period (Mathew, 2006).

Table 4 elabourates the extent of casualization among the different groups of labour based on gender and type of work. Among the male workers, the percentage of self-employed male workersin farm sector (65.6 percent) is higher than the self-employed in the non-farm sector (38.2 percent) in 2011-12. The percentage of regular employees in both farm and non-farm sector has declined across the years (from 1993-94 to 2011-12) and the decline is higher in non-farm sector (4.1 percent) than the farm sector (0.8 percent). The casualization of wage earners in public, as well as other work, is also considered

in the study. The perusal of Table 4 shows that the casual wage earners in non-farm public are higher than that of the farm public. Among the rural female, the trend in self-employment is declining both in farm and non-farm sectors. The declining women in labour force was mainly due to rising mechanization, jobs away from habitat and non-suitability of working environment as well as lack of skills for non-farm employment (Chand & Srivastava, 2014). The trend of casualization of labour in public sector is also increasing tremendously across the years in case of female wage earners in the non-farm sector. The female casual wage earners in public non-farm sector increased tremendously from 10 percent in 1993-94 to 42.7 percent in 2011-12. On the other hand, the female casual wage earners in other non-farm sector works declined from 90 percent in 1993-94 to 57.3 percent in 2011-12. In the case of rural person in general, the self-employment has a declining trend as in case of rural male and rural female. The sharp increase of casual workers in public sector after 2004-05 is probably due to implementation of MGNREGS (Chand & Srivastava, 2014).

Table 5 shows the occupational distribution of wage earners based on the size of land cultivation. Based on the different classes of land ownership, it could be observed that the casualization of labour is enormous in agricultural or farm sector. But in general the trend is declining and the casual workers are found to be moving into the non-farm sector. There could be various reasons for this pattern. Some among them are the continuous and decelerating growth in agricultural sector due to decline in land productivity, high input costs etc. In these conditions, the agricultural sector seemed to be insufficient to overcome the major problems of poverty and unemployment. Therefore, there is a major shift in the wage earners from farm to non-farm sectors. A continuous shift of casual workers from farm to non-farm jobs indicates the same. Among the different land categories, it could be found that the landless persons are more employed in the non-farm sector. The landless non-farm employment increased from 39 percent in 1993 to almost 56 percent in 2011. On the other hand, the agriculture employed persons declined from 61 percent in 1993 to 43 percent in 2011. It is interesting to observe that except for the marginal and small landholder categories, all other land categories and associated wage earners showed a decline in agricultural employment. However, all the land class categories showed an increase in the non-farm

Table 3. Casualization of rural labour: 1983 to 2015-16

Years	Self-employed	Regular employees	Casual labour	Index of Casualization
Rural male				
1983	60.5	10.3	29.2	283
1993-94	57.7	8.5	33.8	398
1999-00	55.0	8.8	36.2	411
2004-05	58.1	9	32.9	366
2009-10	53.5	8.5	38	447
2011-12	54.5	10	35.5	355
2015-16	50.4	11.8	37.7	319
Rural female				
1983	61.9	2.8	35.3	1261
1993-94	58.6	2.7	38.7	1433
1999-00	57.3	3.1	39.60	1277
2004-05	63.7	3.7	32.60	881
2009-10	55.7	4.4	39.90	907
2011-12	59.3	5.6	35.10	627
2015-16	45.1	7.6	47.20	621
Rural person				
1983	57.81	8.46	33.72	399
1993-94	57.96	6.45	35.59	552
1999-00	55.80	6.80	37.40	550
2004-05	60.16	7.06	32.78	464
2009-10	54.15	7.26	38.59	532
2011-12	55.92	8.70	35.38	407
2015-16	49.10	10.70	40.30	377

Source: Calculated based on various rounds of NSSO and 5th EUS of Labour Bureau of India.
Index of Casualization shows the number of casual wage earners for every one hundred regular salaried employees.

Table 4. Extent of casualization across gender and type of work

Years	Male					Female					Person				
	SE	RE	CW Others	CW in Public	Total	SE	RE	CW Others	CW in Public	Total	SE	RE	CW Others	CW in Public	Total
Farm															
1993-94	61.1	1.9	100.0	0.0	37.1	58.7	0.6	100.0	0.0	40.7	60.1	1.4	100.0	0.0	38.5
1999-00	58.6	1.8	99.8	0.2	39.7	56.5	0.7	99.9	0.1	42.8	57.8	1.3	99.8	0.2	40.9
2004-05	63.8	1.3	100.0	0.0	34.9	64.5	0.5	100.0	0.0	35.0	64.1	1.0	100.0	0.0	34.9
2009-10	60.8	1.0	99.9	0.1	38.2	58.8	0.4	99.4	0.6	40.8	60.1	0.8	99.7	0.3	39.1
2011-12	65.6	0.8	99.7	0.3	33.6	64.2	0.6	98.6	1.4	35.2	65.1	0.7	99.3	0.7	34.2
Non-farm															
1993-94	47.6	27.7	94.8	5.2	24.7	58.7	15.8	89.9	10.1	25.5	50.1	24.9	93.7	6.3	24.9
1999-00	45.7	26.5	98.0	2.0	27.7	62.2	17.0	97.1	2.9	20.8	49.3	24.5	97.8	2.2	26.2
2004-05	47.0	24.2	98.5	1.5	28.9	59.6	19.8	95.3	4.7	20.6	49.8	23.2	98.0	2.0	27.1
2009-10	41.1	21.2	94.6	5.4	37.6	43.6	19.8	70.3	29.7	36.6	41.6	20.9	89.9	10.1	37.4
2011-12	38.2	23.6	94.1	5.9	38.2	44.4	20.6	57.3	42.7	35.0	39.5	22.9	86.8	13.2	37.5

Source: Authors estimation based on NSSO Reports No. 409, 458, 515, 537 & 554, Ministry of Statistics and Programme Implementation, Government of India.

employment across self-employed, regularly employed as well as the casual wage earner categories. Besides these inferences, the Table 5 also shows that the regular employees in the farm sector are almost equal to zero percent in small, semi-medium and medium land ownership categories. The regularization in the farm-sector has declined to zero because of multiple reasons such as declining marginal productivity of the regular employed wage earners, high wage rates of the employees as well as the increasing input costs and the declining profitability from the farm sector as a whole. The shift to non-farm employment is least in medium to large farmers, as expected, due to the higher profitability and economic surplus in this land ownership category. Inadvertently, the employment in non-farm sector has shown an inclining trend in all the classes from 21.62 percent in 1993 to around 36 percent in 2011.

Table 6 depicts the occupational distribution of wage earners by the different levels of education. It could be observed that across the years, among the rural males, as the level of education increases, the employment in farm sector declines and shift to non-farm sector or the employment in non-farm sector increases. Similar is the case in rural female as well as the rural persons as a whole. In case of rural male during 1993-94, 83 percent of the illiterate and 70 percent of the primary educated are employed in farm sector while only 37 percent of the rural male who are graduate and above are employed in the agriculture. Similarly, in case of rural female, 89 percent of not literate female are and 79 percent of primary educated are employed in the farm sector while 35 percent of graduate and above female are employed in agriculture. In the same year (1993-94), the percentages of illiterate non-farm employed were 16.82, 10.78 and 8.37 percent among rural male, female and rural persons respectively.

On the other hand, as the level of education increased to graduate level, the non-farm employment figures increased to 62.55, 64.64 and 51.30 percent among the rural male, female and persons, respectively. Based on the Table 6, we could also compare the trend of farmand non-farm employment across the years based on the education. In 2011-12, percent of illiterate rural males, females, and persons employed in the farm sector were 68.56, 80.86 and 74.31 percent, respectively. These figures are relatively lower when compared to their estimates in the previous year. This shows that across the years, despite the level of education there is a general trend of shift of employment towards the non-farm sector. Even based on the level of education, the shift to non-farm employment is found to increase as the level of literacy improves across both the genders as well as the rural persons. The level of non- farm employment increased from 31.44 percent to 65.25 percent from literacy level of zero to graduate level in case of rural male. In case of rural female, this increase was about four times from 19.14 percent (illiterate) to 79.23 percent (graduate and above). Typically, the non-farm employment of rural persons

increased from 25.69 percent to 78.72 percent from zero literacy level to diploma and above. Hence, it could be inferred that literacy level has a positive influence on the non-farm employment and as the level of education increases, there occurs a shift of employment from farm sector to non-farm sector. But the real challenge will be to create employment opportunities for those educated persons who join the labour force after acquiring education in the near future. Most of the employment opportunities have to be created in non-farm sector as the natural choice of the educated youth would be to join the more productive non-farm sectors instead of agriculture.

Table 7 depicts the trends in rural non-farm employment across states. A comparison has been done across the states as well as gender-wise to understand the extent of non-farm employment in the states of India. A perusal of Table 7 indicates that the states like Himachal Pradesh, Punjab, Madhya Pradesh, and Arunachal Pradesh, Jammu and Kashmir are found to have an increase in non-farm employment by about 10 times from 1993 to 2015. In case of Himachal Pradesh, during 1993, the percent of non-farm employment was 4.5, 34.2 and 19.7among rural females, males and rural persons, respectively. These figures however multiplied by almost 10 times in the year 2015 to 58.6 percent (female), 80.7 percent (male) and 76.6 percent (rural person). In case of Jammu and Kashmir, these figures are even higher with 4.6 percent in 1993 to around 83 percent in 2015 for rural females. In the case of rural males and persons, the non-farm employment increased from 38.7 percent to 53.4 percent and 24.2 percent to 56.2 percent respectively from 1993 to 2015. In the case of Punjab, the rural female non-farm employment increased from 7.3 percent in 1993 to 74.4 percent in 2015. While the increase of non-farm employment is higher in these states other states like Kerala, West Bengal, Tripura and Manipur already have a

Table 5. Occupational distribution of persons usually employed by size of land cultivation

Land cultivation class	Year	Self-employed		Regular employees		Casual labour		Total	
		Agriculture	Non-farm	Agriculture	Non-farm	Agriculture	Non-farm	Agriculture	Non-farm
Landless	1993	7.13	19.71	1.90	9.74	51.54	9.98	60.57	39.43
	1999	7.34	19.49	2.03	9.37	50.63	11.14	60.00	40.00
	2004	7.89	22.98	1.24	10.53	44.56	12.80	53.70	46.30
	2009	6.17	20.13	1.01	9.67	43.19	19.84	50.36	49.64
	2011	6.37	22.31	0.78	12.62	36.76	21.16	43.92	56.08
Marginal (0.01 - 1.00 ha)	1993	49.06	9.50	0.77	3.76	32.04	4.86	81.87	18.13
	1999	48.43	9.74	0.74	4.58	31.01	5.50	80.18	19.82
	2004	53.73	11.69	0.34	4.64	22.79	6.82	76.86	23.14
	2009	50.29	11.68	0.38	5.54	22.25	9.86	72.92	27.08
	2011	54.50	11.22	0.25	5.92	16.43	11.68	71.17	28.83
Small (1.01-2.00 ha)	1993	78.71	4.21	0.44	3.33	11.53	1.77	90.69	9.31
	1999	79.25	3.97	0.22	3.75	11.04	1.77	90.51	9.49
	2004	80.81	5.12	0.21	3.41	8.32	2.13	89.34	10.66
	2009	79.18	5.26	0.23	3.66	8.47	3.20	87.87	12.13
	2011	82.41	4.63	0.00	4.17	6.02	2.78	88.43	11.57
Semi-medium (2.01 -4.00 ha)	1993	87.53	3.01	0.65	3.01	4.30	1.51	92.47	7.53
	1999	88.06	3.60	0.45	3.38	3.60	0.90	92.12	7.88
	2004	88.36	3.95	0.21	3.12	2.91	1.46	91.48	8.52
	2009	89.07	3.49	0.00	3.26	2.56	1.63	91.63	8.37
	2011	85.98	4.37	0.00	4.37	2.99	2.30	88.97	11.03
Medium & large(≥ 4.01ha)	1993	91.26	2.99	0.64	2.35	1.71	1.07	93.60	6.40
	1999	92.03	3.19	0.46	2.96	0.91	0.46	93.39	6.61
	2004	90.22	3.46	0.41	3.46	1.43	1.02	92.06	7.94
	2009	89.01	3.59	0.22	3.36	1.35	2.47	90.58	9.42
	2011	89.79	4.18	0.00	4.18	0.70	1.16	90.49	9.51
All class	1993	47.07	10.81	1.13	5.41	30.18	5.41	78.38	21.62
	1999	44.12	11.27	0.96	6.00	31.18	6.47	76.26	23.74
	2004	46.47	13.67	0.68	6.38	25.51	7.29	72.67	27.33
	2009	40.69	13.24	0.49	6.62	26.72	12.25	67.89	32.11
	2011	41.85	14.29	0.50	8.27	21.80	13.28	64.16	35.84

Source: Author's estimation based on NSSO Reports No. 409, 458, 515, 537 & 554 Ministry of Statistics and Programme Implementation, Government of India.

Table 6. Occupational distribution of persons by level of education

Gender	Particulars	1993-94		1999-00		2004-05		2009-10		2011-12	
		Farm	Non-farm	Farm	Non-farm	Farm	Non-farm	Farm	Non-farm	Farm	Non-farm
Male	Not literate	83.18	16.82	81.56	18.44	76.19	23.81	71.05	28.95	68.56	31.44
	Literate and up to middle	70.41	29.59	68.49	31.51	65.31	34.69	62.41	37.59	59.14	40.86
	Secondary and higher secondary	57.42	42.58	57.18	42.82	56.38	43.62	59.06	40.94	54.88	45.12
	Diploma and certificate	-	-	-	-	25.53	74.47	24.25	75.75	22.46	77.54
	Graduate and above	37.45	62.55	39.59	60.41	39.31	60.69	34.74	65.26	34.75	65.25
Female	Not literate	89.22	10.78	88.67	11.33	87.66	12.34	84.03	15.97	80.86	19.14
	Literate and up to middle	79.13	20.87	80.05	19.95	79.29	20.71	77.07	22.93	72.44	27.56
	Secondary and higher secondary	56.34	43.66	65.87	34.13	66.36	33.64	65.81	34.19	62.08	37.92
	Diploma and certificate	-	-	-	-	30.43	69.57	18.24	81.76	15.20	84.80
	Graduate and above	35.36	64.64	24.19	75.81	19.32	80.68	26.33	73.67	20.77	79.23
Persons	Not literate	91.63	8.37	85.12	14.88	82.24	17.76	77.30	22.70	74.31	25.69
	Literate and up to middle	81.91	18.09	70.89	29.11	68.77	31.23	65.87	34.13	62.24	37.76
	Secondary and higher secondary	69.95	30.05	58.25	41.75	58.09	41.91	60.00	40.00	55.95	44.05
	Diploma and certificate	-	-	-	-	25.63	74.37	23.23	76.77	21.28	78.72
	Graduate and above	48.70	51.30	38.14	61.86	36.99	63.01	33.56	66.44	32.63	67.37

Source: Author's estimates based on various rounds of NSSO surveys.

high non-farm employment base even since the year 1993. In 2015, the non-farm employment was highest in Himachal Pradesh 76.6 percent), Kerala (70.2 percent), Tripura (68.4 percent) and Sikkim (58.1 percent) among the rural persons.

Table 8 depicts the employment status of rural wage earners both gender wise, occupation-wise and literacy wise. In case of rural persons, it could be observed that the percentage of illiterate rural person who were self-employed in farm sector was 47.27 percent in 1993-94, which declined to 43.10 percent in 1999-00 to 44.10 in 2011-12. The remaining majority (44.36 percent) was employed as casual labourers in farm sector. In the year 2011-12, the percent of illiterate non-farm casual employed workers were 13.79 percent as compared to 2.41 percent in 1993-94. In case of primary educated rural persons, farm-self-employed persons were 54 percent in 1993-94 which reduced to 40 percent in 2011-12. In case of primary educated non-farm employed, the values increased from 11.44 percent in 1993-94 to 15.52 in 2011-12. Similarly, the educated graduate and above self-employed in non-farm sector was 13.66 in 1993-94 to 20 percent in 2011-12.

In case of regular employed rural persons, the farm employment was zero for all the literacy levels in 1993-94 which increased meagerly to 0.34 among illiterate and 0.29 among the graduate and above. An analysis of the trends in casual employment shows that based on the higher level of literacy, the non-farm employment increases in casual labourers. In 1993-94, the illiterate casual labourers in farm employment were 44.36 percent which tremendously declined to 2.57 percent in graduate and above farm employed. In case of non-farm employment trend in the same year, the not literate non-farm employment was 2.41 percent in 1993-94 which increased to 13.13 percent for the graduate and above literacy level. In the year 2011-12, the casual farm employed in not literate level was 30 percent which declined to 2.14 percent in graduate and above education level. In case of non-farm employment in the same year, casual labour was 13.79 percent in illiterate category which was 2.81 in non-farm category.The lack of skills and technical knowledge appear to be the main barrier for rural workers from entering the non-farm sector. The NSSO surveys show a depressing picture of the level of education and technical skills possessed by the rural workers (Chand *et al.,* 2017).

Similar trend was found among the rural males where self-employed farm employment was higher in 1993-94 which declined in 2011-12. Even though there is a decline, the fall is not as high and rural farm employment is still a major source of employment among the rural males as well as he rural females. In case of rural males, the rural farm employment was 83.18 which declined to 68.56 percent in 2011-12. In case of rural females, this figure was 89.22 percent in 1993-94 which declined to 80 percent in 2011-12 among the illiterate female workers.

Table 7. Trends in rural non-farm employment across states

State	Female						Male						Persons					
Year	**1993**	**1999**	**2004**	**2009**	**2011**	**2015**	**1993**	**1999**	**2004**	**2009**	**2011**	**2015**	**1993**	**1999**	**2004**	**2009**	**2011**	**2015**
Andhra Pradesh	16.3	15.7	21.5	23.6	23.3	22.3	24.4	25.6	33.6	37.0	36.0	37.5	20.7	21.2	28.2	31.3	30.5	31.2
Arunachal Pradesh	3.8	4.9	7.3	13.7	9.6	23.6	20.8	24.4	26.0	29.6	28.9	34.7	13.6	16.6	18.1	24.3	22.1	29.7
Assam	16.8	20.6	11.7	13.8	21.0	29.6	21.8	35.3	30.4	33.4	41.4	45.5	20.8	32.3	25.7	29.5	38.0	41.8
Bihar	8.1	14.3	13.6	17.0	23.2	19.5	18.0	21.0	24.2	35.0	33.4	47.3	15.7	19.4	22.1	33.1	32.4	42.4
Chhattisgarh	0.0	0.0	6.7	8.5	9.8	7.6	0.0	0.0	19.7	19.8	18.6	20.5	0.0	0.0	13.8	15.1	14.9	15.1
Gujarat	9.4	8.0	10.9	7.8	14.5	20.7	28.9	28.6	30.7	28.6	30.1	35.1	21.3	20.2	22.7	21.7	25.4	31.8
Haryana	6.8	7.9	9.4	18.6	14.0	36.0	39.1	40.4	50.6	49.1	49.5	54.0	28.1	31.5	35.9	40.2	42.2	49.9
Himachal Pradesh	4.5	4.9	9.0	12.7	13.0	58.6	34.2	46.2	50.6	57.9	60.2	80.7	19.7	26.4	30.4	37.1	36.7	76.6
Jammu & Kashmir	4.6	6.5	13.4	10.8	15.0	83.3	38.7	33.1	46.2	54.9	64.1	53.4	24.2	23.7	36.1	40.3	49.1	56.2
Jharkhand	0.0	0.0	14.7	27.2	15.6	20.4	0.0	0.0	38.5	50.5	47.9	58.1	0.0	0.0	30.0	45.2	39.4	43.8
Karnataka	15.4	12.2	14.5	19.3	20.6	26.1	21.2	21.5	22.3	27.4	34.1	33.7	18.8	17.9	19.0	24.3	29.8	31.4
Kerala	37.0	40.2	48.3	57.2	61.3	69.8	46.8	57.2	62.9	67.2	71.8	70.3	43.6	51.7	58.0	64.3	68.6	70.2
Madhya Pradesh	6.1	8.4	11.9	12.2	20.0	28.1	12.8	15.8	20.9	20.1	31.0	34.0	10.2	12.9	17.5	17.6	27.9	32.8
Maharashtra	8.8	6.1	9.3	7.9	10.9	12.9	24.7	26.2	28.6	29.0	30.3	29.9	17.4	17.4	20.0	20.6	22.9	23.5
Manipur	39.7	30.4	30.9	65.0	75.9	63.9	34.0	22.0	30.6	39.3	44.1	42.7	36.2	24.7	30.7	46.6	54.5	51.9
Meghalaya	9.5	12.7	15.2	26.9	26.4	27.4	17.5	14.0	20.8	30.7	39.2	22.4	14.0	13.5	18.2	29.3	33.7	24.4
Mizoram	6.6	12.5	8.9	16.4	25.3	24.0	13.4	16.0	15.1	21.2	23.5	28.1	11.1	14.5	12.6	19.4	24.2	26.2
Nagaland	10.7	8.1	9.6	15.3	9.8	16.7	31.5	29.5	30.4	32.4	31.3	39.1	25.1	20.3	20.7	25.9	23.3	29.6
Odisha	15.0	19.6	25.4	23.8	30.7	32.2	21.3	23.0	34.1	36.0	40.7	55.1	19.1	21.8	31.0	32.4	37.8	49.8
Punjab	7.3	9.4	10.3	17.7	24.6	74.4	31.9	36.3	45.3	46.8	56.5	50.5	25.3	27.4	33.1	38.2	47.6	53.2
Rajasthan	7.0	8.1	10.5	27.2	22.6	30.2	30.4	32.7	39.8	43.0	50.1	55.9	20.1	22.3	27.1	36.7	39.2	47.8
Sikkim	34.3	29.9	28.1	35.2	14.4	55.3	43.3	43.1	45.3	51.3	37.7	60.1	41.4	39.2	39.5	46.1	27.2	58.1
Tamil Nadu	21.5	24.1	26.2	27.6	49.4	44.1	36.0	37.8	41.3	42.5	48.4	57.5	29.5	32.1	34.6	36.3	48.8	52.1
Telangana	0.0	0.0	0.0	0.0	0.0	20.8	0.0	0.0	0.0	0.0	0.0	31.6	0.0	0.0	0.0	0.0	0.0	27.0
Tripura	43.4	50.9	51.4	86.4	80.9	83.4	54.5	54.7	57.6	64.2	64.9	58.7	52.4	54.3	56.8	69.4	69.2	68.4
Uttaranchal	0.0	0.0	4.0	7.1	9.8	30.3	0.0	0.0	36.7	49.5	58.0	59.1	0.0	0.0	21.6	30.5	38.6	51.8
Uttar Pradesh	10.0	12.5	13.5	14.6	17.4	28.0	23.7	28.2	33.7	39.1	42.8	47.5	20.0	23.8	27.2	33.1	36.3	44.8
West Bengal	41.1	45.9	41.2	57.6	58.3	51.9	35.3	33.6	36.1	40.6	43.2	51.0	36.7	36.4	37.3	43.7	46.8	51.2
All India	13.8	14.6	16.7	20.6	25.1	28.4	25.9	28.6	33.5	37.2	40.6	45.7	21.6	23.7	27.3	32.1	35.9	41.1

Source: Author's estimation based on NSSO Reports No. 409, 458, 515, 537 & 554, Ministry of Statistics and Programme Implementation, Government of India and 5th EUS of Labour Bureau of India.

Table 8. Employment status of rural workforce occupation-wise, gender-wise and literacy-wise

Year	Rural person							
	Type of employment	Sector	Not literate	Literate & up to middle	Secondary and higher secondary	Diploma and certificate	Graduate and above	All
1993-94	Self-employed	Farm	47.27	54.09	58.66	NA	46.13	46.93
		Non-farm	5.42	11.44	12.96	NA	13.66	10.95
	Regular	Farm	0.00	0.00	0.00	NA	0.00	1.01
		Non-farm	0.54	2.45	10.42	NA	24.51	5.56
	Casual labour	Farm	44.36	27.82	11.30	NA	2.57	30.56
		Non-farm	2.41	4.20	6.67	NA	13.13	4.98
	All	Farm	91.63	81.91	69.95	NA	48.70	78.50
		Non-farm	8.37	18.09	30.05	NA	51.30	21.50
1999-00	Self-employed	Farm	43.10	45.08	46.94	NA	34.67	43.95
		Non-farm	8.59	14.64	15.95	NA	15.53	11.69
	Regular	Farm	0.92	1.04	1.03	NA	1.11	1.00
		Non-farm	1.23	6.08	20.22	NA	44.38	5.91
	Casual labour	Farm	41.10	24.76	10.28	NA	2.36	31.20
		Non-farm	5.06	8.39	5.59	NA	1.94	6.24
	All	Farm	85.12	70.89	58.25	NA	38.14	76.16
		Non-farm	14.88	29.11	41.75	NA	61.86	23.84
2004-05	Self-employed	Farm	47.53	45.74	49.86	21.87	33.82	46.42
		Non-farm	9.31	16.20	19.62	22.44	22.31	13.61
	Regular	Farm	0.79	0.71	0.43	0.34	0.75	0.71
		Non-farm	1.66	5.84	17.23	46.11	39.98	6.42
	Casual labour	Farm	33.92	22.32	7.81	3.43	2.42	25.41
		Non-farm	6.79	9.19	5.05	5.82	0.72	7.43
	All	Farm	82.24	68.77	58.09	25.63	36.99	72.54
		Non-farm	17.76	31.23	41.91	74.37	63.01	27.46
2009-10	Self-employed	Farm	41.13	39.16	46.53	21.13	31.42	40.60
		Non-farm	8.70	15.09	18.30	19.68	18.43	13.38
	Regular	Farm	0.68	0.56	0.32	0.16	0.16	0.54
		Non-farm	1.54	5.34	13.23	49.52	44.18	6.77
	Casual labour	Farm	35.49	26.14	13.15	1.94	1.99	26.67
		Non-farm	12.46	13.70	8.47	7.58	3.84	12.04
	All	Farm	77.30	65.87	60.00	23.23	33.56	67.81
		Non-farm	22.70	34.13	40.00	76.77	66.44	32.19
2011-12	Self-employed	Farm	44.14	40.07	44.61	17.78	30.20	41.68
		Non-farm	9.83	15.52	18.96	17.17	19.92	14.17
	Regular	Farm	0.34	0.58	0.28	0.30	0.29	0.46
		Non-farm	2.07	6.51	15.27	53.19	44.65	8.28
	Casual labour	Farm	29.83	21.59	11.06	3.19	2.14	21.90
		Non-farm	13.79	15.73	9.82	8.36	2.81	13.51
	All	Farm	74.31	62.24	55.95	21.28	32.63	64.05
		Non-farm	25.69	37.76	44.05	78.72	67.37	35.95

As the education level increased in both the genders, the non-farm employment also increased as in case of graduate and above education level. In 1993-94, the farm employed were 37.45 percent while non-farm employed were 62.55 percent in rural males, which improved to 65.25 percent non-farm employed in 2011-12. In case of rural female, in 1993-94, the rural farm employed were 35 percent and rural non-farm employed were 64 percent in graduate and above education level. In 2011-12, these figures rose to 79.23 percent in graduate and above non-farm employed. Hence, it is argued that the level of education is a determining factor for choosing farm or non-farm employment. As level of literacy improves, irrespective of the genders, the rural workforce opts for non-farm employment and there also occurs a reduction in farm employment among the rural literates. This shift to non-farm employment is a proof of the increased profitability and income generation ability of this sector and dependency of the rural workforce in the non-farm sector for income generation.

CONCLUSIONS

More than two-thirds of the population still resides in Rural India. Transformation of rural economy is therefore indispensable for inclusive development of the society. Rural economy is now transforming its occupational structure to non-farm sector. The shift has been mainly to construction, manufacturing and other sectors. Agriculturally forward states like Himachal Pradesh, Punjab, Madhya Pradesh, witnessed a huge increase in non-farm employment from 1993 to 2015. Various dimensions such as farm size, education, skill, gender and regions and its implication on agricultural sector were explored. The non-farm employment in rural India was gaining momentum due to the growth in economy resulting in economic diversification. Gender disaggregated employment of workforce reveals a strong bias against female workers. Casualization of labour was also highest in female workers. While landless and marginal rural workforce was shifting to non-farm employment, the medium and large farmers were still dependent on agriculture for occupation. The lack of skills and technical knowledge appear to be the main barrier for rural workers from entering the non-farm sector. Hence, only the educated and skilled workforce in agriculture is moving out to non-farm sector. These transformations are bringing new challenges to agricultural sector. One possible solution could be labour intensive enterprises for rural employment generation.

REFERENCES

Chadha, G.K (2002). Rural non-farm employment in India: What does recent experience teach us? *The Indian Journal of Labour Economics, 45*(4), 663-94.

Chadha, G.K., & Sahu, P.P. (2002). Post-reform setbacks in rural employment: Issues that need further scrutiny. *Economic and Political Weekly, 29*(21), 1998-2025.

Chand, R., & Srivastava, S.K. (2014). Changes in the rural labour market and their implication for agriculture. *Economic & Political Weekly,49*(10), 47–54.

Chand, R., Srivastava, S.K., & Singh, J. (2017). Changes in rural economy of India, 1971 to 2012. *Economic and Political Weekly*, *52*(52), 65.

Chatterjee, B., & Kundu, A. (2002). Rural non-farm employment in India and globalization: A critical analysis. *The Indian Journal of Labour Economics, 45*(4), 71-81.

Eswaran, M., Kotwal, A., Ramaswami, B., & Wadhwa, W. (2009). Sectoral labour flows and agricultural wages in India, 1983-2004: Has growth trickled down? *Economic and Political Weekly*, *44*(2), 46-55.

Jha, B. (2006). *Rural non-farm employment in India: Macro-trends, micro-evidences,and policy options.* New Delhi: Research Paper, Institute of Economic Growth.

Kashyap, S.P., & Mehta, N. (2007). Non-farm sector in India: Temporal and spatial aspects. *The Indian Journal of Labour Economics, 50(*4), 612-642.

Kundu, A., Sarangi, N., & Dash, B.L. (2003). *Rural non-farm employment: An analysis of rural-urban interdependencies* (Working Paper 196). London, UK: Overseas Development Institute.

Mathew, E.T. (Ed.). (2006). *Employment and unemployment in India: Emerging tendencies during the post-reform period*. New Delhi: Sage Publications Pvt. Ltd.

Pais, J. (2002). Casualisation of urban labour force: Analysis of recent trends in manufacturing. *Economic and Political Weekly, 37*(7), 631-652.

Ranjan, S. (2007). *Review of rural non-farm sector in India: Recent evidence* (No. id: 1215). Retrieved from https://ideas.repec.org/p/ess/wpaper/id1215.html.

Reddy, A.A. (2015). Growth, structural change and wage rates in rural India. *Economic and Political Weekly*, *50*(2), 57.

Reddy, D.N., Reddy, A.A., Nagaraj, N. &Bantilan, M.C.S. (2014).*Rural non-farm employment and rural transformation in India* (Working Paper Series No. 57). Patancheru, Hyderabad: CRISAT.

Sahu, P.P. (2003). Casualisation of rural workforce in India: analysis of recent trends. *The Indian Journal of Labour Economics, 46*(4), 927-39.

Sinha, A. (2007). Farm sector, non-farm employment, and rural livelihood: A Study. *Social Change, 37*(1), 50-76.

Venkatesh, P. (2013). Recent trends in rural employment and wages in India: Has the growth benefitted the agricultural labours? *Agricultural Economics Research Review*, *26*(2013).

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 297-301
DOI: 10.5958/2322-0430.2018.00074.4

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Impact of Public Sector Capital Investment in Punjab Agriculture

Shaveta Garg

Assistant Professor, Department of P.G. Studies, Punjabi University Regional Centre, Bathinda, Punjab

Email: shavetagarg2@gmail.com

Received: December 31, 2017 *Manuscript Number: NS-18-65* *Revision Accepted: February 13, 2018*

ABSTRACT

For changing the status of agriculture from subsistence level to business level, adequate infusion of capital is utmost important like spine in the body. The main objectives of the present study are to study the trend and pattern of capital formation in agriculture in Punjab, to examine the share of capital formation in agriculture and allied sector in the Gross Capital Formation in Punjab, its share in the Gross Domestic Product of the State, to analyse the share of Gross Domestic Product of agriculture to Gross Domestic Product of the State. Capital formation unveils the potentiality of the investment in the public as well as the private sectors and gives net addition to the assets created. The study is based on secondary sources. The different statistical tools, tables, averages and percentages, index numbers are used for the analysis. The period of study is 1980-81 to 2013-14 at 2004-05 constant prices. It is observed that the agriculture and allied sector are contributing less to total gross capital formation as compared to non-agriculture sectors. Share of agriculture sector has decreased, gradually, in the growth rate of the economy. Public sector capital formation in agriculture and allied sectors has come down whereas that of private sector has gone up. Some of the policy implications arising out of this research study are: Diverting resources from subsidies to public sector capital formation. A big push of public investment in agricultural sector is required.

Keywords
Capital investment, public sector, capital formation, domestic product.

JEL Codes
C22, E22, O16, R53.

INTRODUCTION

Punjab is the most frequently quoted success story in the records of agricultural development in India. Economic development in Punjab has been led by agriculture and small-scale industry which were behind the success story of the State during seventies and eighties. After the decade-long militancy in the State during 1980s, the peace period accompanied the change in policy regime to liberalization, privatization, and globalization. The growth rate of Punjab economy decelerated and the dynamism of Punjab economy was lost. All the major states of the country except Bihar, Uttar Pradesh, and Orissa experienced higher growth rates than Punjab. Punjab which is considered the granary of India is facing a grave crisis. Farmers' suicides have been reported here too. Many terms have been coined to depict the phenomenon. 'A success story turning into a case of failure', 'a successful past but an uncertain future', 'economy at crossroads', are some such phrases.

Capital is one of the important inputs which is definitely and sufficiently required for further growth in agricultural production and productivity for the underprivileged and underfed and ever-increasing population of the country. For changing the status of agriculture from subsistence level to business level, adequate infusion of capital is utmost important like spine in the body.

REVIEW OF LITERATURE

Economic literature is full of the examples of intimate connection between capital formation and growth at micro and macro levels in any sector including agriculture. Singh *et al.* (1978) studied capital formation at the micro level in the Punjab agriculture. The main objectives of the study were to examine the factors affecting capital formation in Punjab and changes in the relative significance of different variables affecting

capital formation over time. It was found that the base year capital, farm size, lagged net income and the family size were the important variables that affected capital formation.

The main contributing factor for the declining trend in investment in agriculture during 1980s was the slowing down of investment in irrigation facilities by the public sector. In later years, the addition to gross irrigated area continued to decline. Net irrigated area by surface water resources like canals and tanks remained stagnant during 1980s which were generally government controlled. Groundwater resources like wells and tubewells shown an increasing trend which was largely due to investment by private sources. The source of problem was decline in public sector investment (Kumar, 1992).

Deceleration in the food grain output during the 1980s became a cause for concern due to the well-founded linkages of public spending with agricultural growth and reduction in rural poverty through the increase in productivity and employment, and the decline in prices (Fan *et al.,* 1999). Substantial evidence exists on the positive impact of investments in irrigation, agriculture, education and infrastructure such as roads and power, on-farm productivity. The impact may be direct as well as indirect, total private farm investment is positively enhanced by public investment through the 'crowding in' effect (Mitra, 1996).

Wagle (1994) in his study said that during the decades of the 1970s and 1980s agricultural output in India had recorded encouraging growth. Credit for this growth goes both to technological factors and rise in government as well as private investment in agriculture. As higher government investment stimulates more private investment, the government should ensure reversal of the downward trend in public sector investment in agriculture as reflected in its share in the Gross Domestic Product at factor cost. A direct relationship between capital intensity and productivity of land and labour and their inverse relation with the incidence of poverty have also been observed. The empirical evidence on the linkages between public spending and investment by farmers makes the implications for government investment policy quite apparent (Bisaliah *et al.,* 2013).

Relevance of the Study

Stagnation in agriculture, import of foodgrain, widespread suicides by the farmers are the direct results of the falling health of agriculture in Punjab, which require intensive review of the government policies. Increasing suicides by the farmers amply portray the real picture of agriculture in Punjab where farmers have been left at the mercy of market forces which are heavily tilted against them. It is the need of the hour to turn the agriculture remunerative so that the families and farmers can earn at least that much income with which they can live in a dignified manner. For all this, capital formation is one of the significant factor. It is quite relevant in the present times to study the trend and pattern of capital formation in agriculture in Punjab, to examine the share of capital formation in agriculture and allied sector in the Gross Capital Formation in Punjab, its share in the Gross Domestic Product of the State, to analyse the share of Gross Domestic Product of agriculture to Gross Domestic Product of the State. Capital formation unveils the potentiality of the investment in the public as well as the private sectors and gives net addition to the assets created.

Research Methodology

The study is based on secondary sources. Secondary data are collected from Agriculture Census, Statistical Abstracts of Punjab, Central Statistical Organisation, Economic and Statistical Organisation, Government of Punjab, published and unpublished sources of Department of Agriculture, Government of Punjab. The different statistical tools, tables, averages and percentages, index numbers are used for the analysis. The period of study is 1980-81 to 2013-14 at 2004-05 constant prices.

RESULTS AND DISCUSSION

Trend of Agricultural Capital Formation in Punjab

Capital formation in agriculture sector of Punjab forms a very vital aspect as Punjab is recognized as the food bowl of India. The demand for capital in agriculture sector increases with transformation of the agriculture from traditionalism to commercialization. The stone of commercialization in Punjab agriculture was laid with the introduction of high-yielding varieties of wheat and rice, followed by use of chemical fertilizers and investments in irrigation (especially tubewells), agro-chemicals to control weeds, diseases, and insect-pests management, and tractorization to ensure timeliness and meticulousness in farm operations. Favourable output pricing policy assured marketing, and subsidies on inputs like power and fertilizers further smoothed this process.

The perusal of Table 1 shows the share of gross capital formation of agriculture and allied sectors in total gross capital formation in Punjab at 2004-05 prices. Gross capital formation in agriculture and allied sectors increased from ₹792.82 crores in 1980-81 to ₹2,742.50 crores in 1991-92. Thereafter, it declined, with fluctuations, to reach the level of ₹2,415.86 crores in 2013-14. Total gross capital formation of Punjab increased from ₹3,830.85 crores in 1980-81 to ₹29,937.97 crores in 2013-14. Share of agriculture and allied sector was 20.70 percent per annum in total gross capital formation in Punjab in 1980-81. Thereafter, a decrease can be seen in the contribution to 8.07 percent per annum in 2013-14. This depict that the share of agriculture and allied sector in total gross capital formation has declined gradually to almost half from 1980-81 to 2013-14 and that of non-agriculture sector has increased in total gross capital formation. A decline of investment in agriculture and allied sectors is a matter of alarm as increasing number of populace relies on this sector for sustenance.

The gross state domestic product in agriculture and

Table 1. Share of gross capital formation of agriculture and allied sectors in total gross capital formation (At 2004-05 Constant Prices), Punjab (₹ Crores)

Year	GCFAA	Total GCF	Share of GCFAA as percent of total GCF
1980-81	792.82	3830.85	20.70
1985-86	1331.54	7436.55	17.91
1990-91	2100.50	10925.17	19.23
1995-96	2240.96	19120.26	11.72
1999-00	2050.67	13161.14	15.58
2004-05	1836.60	19028.44	9.65
2009-10	2152.92	23247.93	9.26
2012-13	2453.97	28068.57	8.74
2013-14	2415.86	29937.97	8.07

Source: Statistical Abstract of Punjab, various issues.
GCFAA= Gross Capital Formation in Agriculture and Allied Sectors.
GCF= Gross Capital Formation.

Table 2. Share of gross capital formation of agriculture and allied sector in total gross state domestic product (At 2004-05 Constant Prices) Punjab (₹ Crores)

Year	GCFAA	Total GSDP	Share of GCFAA as percent of Total GSDP
1980-81	792.82	31515.21	2.52
1985-86	1331.54	41405.80	3.22
1990-91	2100.50	51981.36	4.04
1995-96	2240.96	64187.22	3.49
1999-00	1952.30	82888.43	2.36
2004-05	1866.54	102556.08	1.82
2009-10	2152.92	138636.50	1.55
2012-13	2453.97	164602.20	1.49
2013-14	2415.86	174037.70	1.39

Source: Statistical Abstract of Punjab, Various Issues.
GCFAA= Gross Capital Formation of Agriculture and Allied Sector.
GSDP= Gross State Domestic Product.

allied sectors increased from ₹13,011.82 crores in 1980-81 to ₹37,229.89 crores in 2013-14 at 2004-05 prices. Share of gross capital formation of agriculture and allied sector in gross domestic product of agriculture and allied sector has increased from 6.09 percent per annum in 1980-81 to 11.22 percent per annum in 1992-93. Thereafter, it started declining and continued to decline to reach 8.32 percent per annum in 1996-97. This share increased from 8.32 percent per annum in 1996-97 to 10.79 percent per annum in 1998-99, then declined to reach 6.49 percent per annum in 2013-14.Share of agriculture and allied sector in the gross domestic product of agriculture and allied sector is a matter of concern as Punjab is the food bowl of India.

Table 2 shows the share of gross capital formation of agriculture and allied sector in gross domestic product of Punjab at 2004-05 prices. Total gross domestic product increased from ₹31,515.21 crores in 1980-81 to ₹1, 74,037.70 crores in 2013-14. Share of gross capital formation of agriculture and allied sector in total gross domestic product of Punjab was 2.52 percent per annum in 1980-81 which increased till 1991-92 to reach 5.04 percent per annum and then started declining to reach the level of 1.39 percent per annum in 2013-14. Share of gross capital formation of agriculture and allied sector in total gross domestic product has decreased to almost half from 1980-81 to 2013-14 which means less investment is being done in agriculture and allied sector of the economy which is contributing less to the growth rate of the economy.

Share of gross capital formation of non-agriculture sector in total gross capital formation of Punjab increased from 79.30 percent per annum in 1980-81 to 88.28 percent per annum in 1995-96 and then declined to 83.86 percent per annum till 2002-03 and thereafter increased to reach 91.93 percent per annum in 2013-14. Therefore, it is depicting a rising share of gross capital formation of non-agriculture sector in total gross capital formation of Punjab. This means more investment is being done in non-agriculture sector of the economy as compared to the agriculture sector with the passage of time.

Share of gross capital formation of non-agriculture sector in total gross domestic product of Punjab at 2004-05 prices increased from 9.64 percent per annum in 1980-81 to 26.30 percent per annum in 1995-96 and then decreased to reach 15.81 percent per annum in 2013-14. Increase in the share of gross capital formation of non-agriculture and allied sector depicts increase in investment in non-agriculture and allied sector thereby contributing more to the growth rate of the economy as compared to agriculture and allied sector of the economy. Punjab being an agricultural economy, capital formation in agriculture sector is required more than non-agriculture sector.

Share of gross capital formation of non-agriculture sector in gross state domestic product of non-agriculture sector at 2004-05 prices was 16.42 percent per annum in 1980-81 increased to 43.27 percent per annum in 1995-96 and then declined to reach 20.12 percent per annum in 2013-14. Increase in the investment in non-agriculture sector of the economy leads to rise in gross domestic product of non-agriculture sector.

Public and Private Capital Formation in Punjab Agriculture

Capital formation unveils the potentiality of the investment in the public as well as the private sectors and gives net addition to the assets created during the year. Public sector investment is undertaken for building necessary infrastructure, investment in irrigation schemes and plantations in forestry sector. Irrigation would account for almost 90 percent of the gross public capital formation in agriculture (Bisaliah *et al.*, 2013). Private

investment in agriculture is made either for augmenting productivity of natural resources or for undertaking such activities, which supplement income sources of farmers. Private sector investment includes investments by (a) farm households and (b) private corporates. Investments made by farm households on farm equipment, machinery, irrigation, land reclamation and land improvement are included. The corporate sector investment includes investment by organized corporate bodies like big private companies and unorganized entities like sugar cooperatives and milk co-operatives.

The share of gross capital formation by public sector in Punjab in gross capital formation of agriculture and allied activities was 26.63 percent per annum in 1980-81 and gross capital formation by private sector was 73.37 percent per annum. In the year 2009-10, share of public sector in gross capital formation in Punjab has declined to 11.95 percent per annum and share of private sector has increased to 88.04 percent per annum. In the year 2013-14, the share of gross capital formation by public sector in Punjab in gross capital formation of agriculture and allied activities was 4.07 percentp er annum and share of gross capital formation by private sector was 95.93 percent per annum (Table 3).

There had been stagnation in private sector capital formation in agriculture during 1990s, which could be due to many reasons generally held belief of over-capitalization of Punjab agriculture that might have reached unsustainable levels in the 1990s. Punjab Development Report (2002) states that most of the private investment has gone into farm machinery and irrigation structures. As a result, the State has a high degree of mechanization of farm operations. Since capital intensity is increasing among all categories of farmers, particularly in large farmers. It is making agriculture less profitable, as net returns are declining due to the higher cost of cultivation. While a higher share of private sector investment in agriculture is a welcome feature, public sector investment is critical as it is generally found to accelerate private investment.

CONCLUSION AND POLICY IMPLICATIONS

It is observed that the agriculture and allied sector are contributing less to total gross capital formation as compared to non-agriculture sectors. Investment rate in the agriculture measured as a ratio of gross capital formation to gross domestic product to the sector has improved. Share of agriculture sector has decreased, gradually, in the growth rate of the economy. Public sector capital formation in agriculture and allied sectors has come down whereas that of private sector has gone up. The declining tendency of public investment is not conducive for sustainable growth in agriculture. Private sector investment can never be a substitute for public sector investment, particularly in agricultural infrastructure. Therefore, this declining trend in public sector agricultural investment needs to be reversed by augmenting agricultural credit and increasing allocation for agriculture. The policy implications arising out of this research study are detailed below:

Government had to assume the role of entrepreneurs in the agricultural sector which needed a big push with a view to bringing about a complete overhauling of the on-going traditional technique of production for quickly achieving the objective of the increase in production and productivity.

Since agriculture forms the resource base for a number of agro-based industries and agro-services, it would be more meaningful to view agriculture not as farming alone but as a holistic value chain, which includes farming, wholesaling, warehousing (including logistics),

Table 3. Gross public and private capital formation in Punjab agriculture and allied sector (At 2004-05 Constant prices)

(₹ Lacs)

YEAR	GCFAA	PUBGCFA	PVTGCFA	PUBGCFA as percent of GCFAA	PVTGCFA as percent of GCFAA
1980-81	77306	20588	56718	26.63	73.37
1985-86	128497	39801	88697	30.974	69.03
1990-91	207823	21214	186609	10.21	89.79
1995-96	222735	73404	149331	32.96	67.04
2000-01	193493	36466	157027	18.85	81.15
2005-06	185865	18737	167128	10.08	89.92
2009-10	214523	25636	188887	11.95	88.05
2012-13	244078	15914	228164	6.52	93.48
2013-14	240188	9787	230401	4.08	95.93

Source: Economic and Statistical Organization, Government of Punjab.
GCFAA = Gross Capital Formation of Agriculture and Allied Activities.
PUBGCFA = Public Sector Gross Capital Formation in Agriculture and Allied Activities.
PVTGCFA = Private Sector Gross Capital Formation in Agriculture and Allied Activities.

processing, and retailing.

Diverting resources from subsidies to public sector capital formation is highly desirable to ensure growth in Gross Domestic Product in agriculture. Sometimes subsidies does not necessarily result in capital formation as these have a scope/tendency of less/ misutilization, whereas, public sector capital investment has long-term benefits as has been observed from the past experiences. Subsidies have short-term benefits and capital formation have long-term benefits.

Investment in deepening tubewells to extract groundwater from more depth due to falling water table gradually requires considerable investment in irrigation assets. Much more public investment is required for recharging of groundwater through rain water harvesting; improve water use efficiency and saving of water resources of the State.

The efforts, so far, on small farms by way of increased credit has borne fruit with increased capital formation on these farms. This calls for sustenance of these efforts coupled with strengthened extension facilities further boosting the lot of small farms and the rural economy, in general. The policymakers need to liberalize credit directed towards formation of productive assets, commercialization of agriculture and better extension efforts.

To enhance income of the farmers, subsidiary enterprises like dairy farming, poultry farming, bee-keeping, mushroom farming, fish farming, flower cultivation, fruit, and vegetable cultivation may be encouraged by the policymakers and administrators. Since these are capital-intensive and risky crops/enterprises, the availability of capital and market has to be ensured before these are adopted on large scale.

All these factors point to just one thing: that agriculture has to be kept at the center of any reform agenda or planning process, in order to make a significant dent on poverty and malnutrition and to ensure long-term food security for the people. Increase in investment in agricultural sector is critical for the future growth of agriculture. There has been substantial concern about the low level of capital formation and investment in agriculture sector. The Government should review and restructure the policies so as to ensure continuous increase in public and private investment.

REFERENCES

Bisaliah, S., Mahendra Dev, S., & Saifullah, S. (2013). *Investment in Indian agriculture: Macro and micro evidences*. New Delhi: Academic Foundation.

Fan, S., Hazell, P., & Thorat, S. (1999). *Linkages between government spending, growth, and poverty in rural India.* Report submitted to International Food Policy Research Institute, Washington D.C.

Kumar, A.G. (1992). Falling agricultural investment and its consequence. *Economic and Political Weekly*, *42*, 2307.

Mitra, A. (1996). Public and private investments in agriculture. In B.M. Desai (Ed.), *Agricultural development paradigm for the ninth plan under new economic environment.* New Delhi: Oxford and IBH.

Singh, B., Kalhon, A.S., & Singh, K. (1978). A micro level study of capital formation in Punjab agriculture. *Indian Journal of Agricultural Economics*, *33*(2), 21-30.

Wagle (1994). Estimates of private investment in Indian agriculture. *Indian Journal of Agricultural Economics*, *49*(1), 56-61.

www.soed.in

Indian Journal of Economics and Development (2018) 14(2a), 302-307
DOI: 10.5958/2322-0430.2018.00075.6

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Effect of Non-farm Employment on Farm Commercialization

Subhash Jagdambe[1], C.P. Shiji[1], S.P. Subash[2] and S.J. Balaji[2]*

[1]*Research Associates and* [2]*Scientists, ICAR-National Institute of Agricultural Economics & Policy Research (NIAP) New Delhi-110012*

[*]*Corresponding author's email: shjagdambe@gmail.com*

Received: December 31, 2017 *Manuscript Number: NS-18-72* *Revision Accepted: February 16, 2018*

ABSTRACT

The paper investigates how non-farm employment affects commercialization of agriculture in rural agricultural households in India. The data for the study was drawn from a nationally representative sample collected by NSSO through Situation Assessment Survey 2013. Regression Adjustment (RA) treatment effect model was used to measure the effect of household's participation in non-farm employment on the marketed surplus of cereals, pulses, and oilseeds. Results show that household's participation in non-farm employment has a significant negative influence on agricultural commercialization of cereals and oilseeds. The results also infer that farm households use additional income from non-farm activities for non-agricultural consumption purpose. Though the results are found to be similar to previous empirical studies, the relative difference in marketed surplus was lower and was only 9 percent in case of cereals and 2 percent in case of oilseeds. The study concludes that the engagement of households in the non-farm sector would push those households away from agriculture as a commercial activity.

Keywords
Adjustment Treatment Effect Method, commercialization, non-farm employment.

JEL Codes
Q1, Q12, Q13.

INTRODUCTION

Agriculture in India is predominantly subsistence-based with small-holder farmers constituting the major share of cultivators. The rapid growth in the Indian economy in the past few decades has resulted in a structural transformation. The share of agriculture in total GDP has been declining gradually since independence (53.8 percent in 1950-51 to 15.1percent in 2015-16). Despite declining share of agriculture, it continues to be the major source of livelihood in rural India (47 percent labour force is in agriculture) (The World Factbook, 2014). The average size of land-holdings has decreased from 2.28 ha per capita in 1970-71 to 1.15 ha in 2010-11 (Ministry of Agriculture, 2010-11). This translates into the predominance of small and marginal farmers in the Indian agriculture sector. This structural shift in employment in agriculture has resulted in many agricultural labourers and small and marginal farmers moving away from agriculture sector to the construction, manufacturing sector, and the services sector. Most of the labourers have found employment in manufacturing, construction, trade, hotels and restaurants, community and social service etc. This structural shift is inevitable because subsistence agriculture that is largely practiced by smallholder farmers may not be viable to achieve household food security and welfare in the long run (Pingali, 1997).

The non-farm rural economy has been thriving due to the availability of surplus labour from agriculture and is contributing significantly to the growing prosperity of rural India. Its share in rural income has increased from 35 percent in 1980-81 to 62 percent in 2004-05 (Government of India, 2010). This could help the rural smallholder farmer to survive risks of crop failure and invest in productivity-enhancing agriculture inputs

(Woldeyohanes *et al.,* 2015). Commercialization of agriculture is the key agriculture-based development strategy for smallholder farmers (Muriithi & Matz, 2015). This is also a crucial component of the structural transformation process in which farm households shift towards commercialized production (Jayne *et al* 2011; Woldeyohanes *et al.,* 2015). The present study explores how participation of agriculture household in non-farm activities helps in agricultural commercialization. The theoretical reasoning behind it is that income from non-farm sources could be invested into agriculture resulting in increased production and higher marketable surplus (Woldeyohanes *et al.* 2015). Several macro studies have been conducted exploring the linkage between off-farm employment and their impact on poverty in India (Kaur *et al*., 2010; Parida*,* 2015). But the interaction of non-farm employment and agricultural commercialization at the household level is least explored. The present study adds to the empirical literature on the effect of off-farm employment on agricultural commercialization at the household level.

DATA AND METHODOLOGY

The data for the study is based on a nationally representative survey by National Sample Survey Office on Situation Assessment Survey of Agricultural Households, 2013. In the survey, various household and farm-related information of agricultural households in rural India were collected. The survey was conducted in two major agricultural seasons, in two visits; visit1 (January to July 2013) and visit 2 (August to December 2013) respectively. A total of 35200 households were surveyed in visit 1 and 34907 in visit 2. From the data we had used information on household level employment, household head's age, education, household size, number of male and female members in the household, caste, land holding, total production, total sale, and access to information sources to build the model. The hypothesis on the relationship between the variables is drawn from previous studies (Kaur *et al*. 2010; Woldeyohanes *et al.,* 2015; Amare & Shiferaw, 2016).

We had fitted separate regressions for cereals, pulses and oilseed crops. These crops are considered as major crops with regard to consumption and production. We had taken the quantity of products sold and its percentage in total production (marketed surplus) as the outcome variable. These variables are used as a proxy for extent of commercialization.

Previous studies had used Heckman sample selection model or Tobit model or double hurdle or switching regression models (Woldeyohanes *et al.*, 2015). An alternative for these models with binary treatment effect in an observational study is Regression Adjustment (RA) treatment effect method. The advantage of using the method lies in controlling the bias in selection and its disadvantages are discussed in a seminal work by Rubin (2006). We had taken engagement of household in non-farm activities as a binary variable and used RA treatment effect model for our analysis. The RA method is based on the idea that we can use sample means for estimating the treatment effects by employing regression model to predict potential outcomes adjusted for covariates. The empirical form of the model is

$$Y_i = \quad +\beta x_i + \varepsilon_i$$

Where y_i is the outcome variable, x_i is set of covariates (control variables) and ε_i the error term. The basic assumption is that we can estimate E $(y_0|x)$ and E $(y_1|x)$ directly from observation for which t=0 (farm household [control]) and t=1(non-farm household[treatment]). Two separate equations are fitted for each treatment and averages of predicted outcomes are used to estimate predicted outcome means (POMs). The average causal effect can be estimated using average treatment effect (ATE) and the average treatment effect on the treated (ATET). ATEs are the difference in the estimated POMs and ATETs are the difference in averages of predicted outcomes over the treated observations.

RESULTS AND DISCUSSION

In rural India, the major source of income is crop cultivation followed by livestock-rearing and wage employment. It can be seen from Table 1 that 92 percent of the rural agricultural households are receiving income from crop cultivation including about 72 percent of rural households from livestock activities. Wage employment is also a major source of income for about 49.51percent of households across rural agricultural India. However, income from other agriculture activities, pension and remittances were less common among the rural agricultural households of India with only about 7percent receiving a pension and 10 percent receiving remittances of the total rural agricultural population.

Table 2 presents the results of the marketed surplus of households by income source. It was noticed that, in the case of cereals, the marketed surplus was more (33.42 percent) for those who were earning income predominantly from agriculture activities. This was followed by households with other income sources like non-agriculture and others (30 percent) for cereals. In case of pulses, wage earners had more marketed surplus

Table 1. Income sources of agricultural households in rural India

Income	Percentage
Crop production	92.63
Livestock	71.95
Other Agricultural	9.40
Non-Agricultural business	14.68
Wage and salaries	49.51
Pension	7.26
Remittance	10.75
Others	2.89

Source: Authors' Calculation based on Situation Assessment Survey of Agricultural Households (SASAH), 2013.

Table 2. Marketed surplus of households by income sources

Major income source	Cereals	Pulses	Oilseeds
Agriculture*	33.42	25.95	46.67
Non-Agricultural business	30.53	23.42	38.83
Wages	27.29	27.94	49.63
Others	30.82	22.12	35.36

Source: Authors' Calculation based on SASAH (2013).
**Agriculture includes Crop production, Livestock, and Other agricultural activities.*

(27.94 percent), followed by agricultural households (25.95 percent), non-agriculture (23.42 percent) and others (22.12 percent). Further, for oilseeds also it was observed that marketed surplus was the highest for wage earner (49.63 percent), followed by agricultural households (46.67 percent) and by households engaged in non-agricultural activities (38.83 percent).

The land is considered as a household's asset. Hence, the paper also calculates marketed surplus for major agricultural crops such as cereals, pulses, and oilseeds according to the size of land possessed and the results are presented in Table 3. It is clearly found that the marketed surplus for the three crop groups has been increasing with the increase of land size. It means that size of land holdings is an important determinant of the marketed surplus of cereals, pulses, and oilseeds. For cereals, the marketed surplus has been increasing from 20.33 percent for marginal farmers to 59.59 percent for large farmers. In case of pulses, marginal farmers showed a low marketed surplus compared to large farmers for whom the marketed surplus was 42.62 percent. The same pattern was noticed in the case of the marketed surplus of oilseeds.

Table 3. Marketed surplus of households by land class

Land wise classification	Cereals	Pulses	Oilseeds
Sub-marginal (<0.5ha)	20.33	17.11	30.68
Marginal (0.5-1ha)	28.94	21.95	42.73
Small (1-2 ha)	39.00	26.45	47.54
Medium (2-4ha)	49.89	34.78	58.13
Large (>4ha)	59.59	42.62	68.70

Land class based on cropped area.
Source: Authors' Calculation based on SASAH (2013).

Table 4. Marketed surplus of households by employment

Crops	Farm	Non-farm	Standard error	p-value
Cereals	41.49	28.79	0.22	0.000
Pulses	26.40	25.69	0.47	0.467
Oilseeds	49.35	44.75	0.55	0.000

Source: Authors' Calculation based on SASAH (2013).
Farm is households that are engaged only in agricultural activities. Non-farm is households that are engaged in agriculture, non-agricultural enterprises and wage & salary.

Table 5. Descriptive statistics

Variable	Definitions	Mean	Standard deviation	Minimum	Maximum
Number of adult males in a household	Number of male aged 15 years and above	1.96	1.15	0.00	15.00
Number of adult females in a household	Number of female aged 15 years and above	1.89	1.07	0.00	13.00
Age of the household head	=1 if age of individual<=30 years; 0 otherwise	50.67	13.48	16.00	103.00
Dummy: illiterate (reference)	=1 if illiterate and less than primary; 0 otherwise	0.35	0.48	0.00	1.00
Dummy: primary	=1 if passed primary; 0 otherwise	0.13	0.33	0.00	1.00
Dummy: middle	=1 if passed middle ; 0 otherwise	0.11	0.32	0.00	1.00
Dummy: higher secondary and above	=1 if higher secondary; 0 otherwise	0.06	0.23	0.00	1.00
Dummy: graduate and above	=1 if higher graduate; 0 otherwise	0.13	0.33	0.00	1.00
Dummy: OBC castes	= 1 if social group is OBC; 0 otherwise	0.40	0.49	0.00	1.00
Dummy: ST castes	=1 if social group is ST; 0 otherwise	0.19	0.39	0.00	1.00
Dummy: SC castes	=1 if social group is SC; 0 otherwise	0.13	0.34	0.00	1.00
Dummy: other castes (reference category)	= 1 if social group is others; 0 otherwise	0.27	0.45	0.00	1.00
Household size	Household Size	5.36	2.69	1.00	41.00
Land owned	Land owned by household (in hectares)	1.39	1.71	0.00	50.62

Source: Authors' Calculation based on SASAH (2013).

The t-test results are presented separately for farm and non-farm sectors. The percentage mean value of marketed surplus for farm and non-farmsectors along with standard error and p-value for cereals, pulses and oilseeds are given in Table 4. For farm sector, the percentage marketed surplus of cereals is 41.49 percent followed by 26.40 percent and 49.35 percent for pulses and oilseeds, respectively. Under the non-farm sector, the percentage mean marketed surplus of cereals was 28.79 percent, pulses 25.69 percent and was 44.75 percent for oilseeds. The mean marketed surplus values by sector were found to be significant for cereals and oilseeds (p = 0.00) but insignificant for pulses (p=0.46).

The demographic characteristics of households used in the model estimation and their descriptive statistics are presented in Table 5.

The potential outcome means (percent marketed surplus) for non-farm and farm households and their estimated regression coefficients are shown in Table 6. The estimated potential outcome means show the marketed surplus of cereals among farm households (39 percent) higher than non-farm households (30 percent). Similarly, in case of oilseeds, the marketed surplus was higher in farm households (47 percent) than non-farm households (45 percent). But in case of pulses, the marketable surplus was higher among non-farm households (26 percent) than farm households (25 percent). The coefficients (signs) of variables in regression estimates were found to be similar to the previous studies.

The effect of non-farm employment on total sales and marketed surplus (Percent of produce sold in total

Table 6. Potential outcome means and regression estimates

Variables	Coefficient	Robust SE	p-value	Coefficient	Robust SE	p-value	Coefficient	Robust SE	p-value
	Cereals			Pulses			Oilseeds		
PO means									
Farm	39.224	0.371	0.000	25.563	0.813	0.000	47.948	0.866	0.000
Non-Farm	30.333	0.285	0.000	26.219	0.603	0.000	45.524	0.728	0.000
OME0									
adult_male	2.645	0.440	0.000	-0.695	0.969	0.473	-0.034	1.016	0.973
adult_female	-0.040	0.507	0.937	0.433	1.154	0.708	1.226	1.191	0.304
Age1	0.184	0.176	0.296	-0.212	0.406	0.602	-0.589	0.412	0.153
age_square	-0.002	0.002	0.173	0.001	0.004	0.881	0.002	0.004	0.563
primary_edn	1.111	1.117	0.320	0.985	2.476	0.691	8.038	2.537	0.002
secondary_edn	2.962	1.076	0.006	-0.617	2.391	0.796	-3.095	2.538	0.223
higher_edn	4.242	1.453	0.004	-6.807	2.888	0.018	-11.607	3.225	0.000
caste_OBC	-3.254	0.851	0.000	3.878	1.770	0.028	5.162	1.855	0.005
caste_ST	-14.137	1.090	0.000	6.219	2.843	0.029	23.244	2.729	0.000
caste_SC	-5.730	1.337	0.000	3.277	3.072	0.286	1.715	3.351	0.609
household_size	-1.609	0.228	0.000	-1.439	0.486	0.003	-2.164	0.540	0.000
Land_Own_ha	3.709	0.269	0.000	2.678	0.484	0.000	3.691	0.537	0.000
_cons	38.275	4.583	0.000	36.143	10.542	0.001	69.832	10.502	0.000
OME1									
adult_male	2.479	0.305	0.000	1.117	0.641	0.081	2.028	0.792	0.010
adult_female	1.629	0.352	0.000	-0.340	0.731	0.641	0.269	0.909	0.767
Age1	0.286	0.124	0.021	0.129	0.263	0.624	0.045	0.337	0.894
age_square	-0.003	0.001	0.015	-0.003	0.002	0.184	-0.003	0.003	0.372
primary_edn	-0.748	0.781	0.338	2.056	1.795	0.252	1.544	2.250	0.493
secondary_edn	4.230	0.902	0.000	-2.876	1.923	0.135	-3.367	2.257	0.136
higher_edn	0.646	1.100	0.557	-7.904	2.172	0.000	-14.254	2.663	0.000
caste_OBC	1.363	0.704	0.053	9.200	1.417	0.000	14.994	1.658	0.000
caste_ST	-8.902	0.713	0.000	7.359	1.696	0.000	24.341	2.324	0.000
caste_SC	-0.465	0.934	0.618	6.218	1.940	0.001	14.372	2.285	0.000
household_size	-2.067	0.162	0.000	-1.600	0.342	0.000	-2.598	0.420	0.000
Land_Own_ha	4.746	0.340	0.000	2.754	0.466	0.000	3.377	0.535	0.000
_cons	20.663	3.140	0.000	25.764	6.900	0.000	44.540	8.816	0.000

PO means are potential outcome means. OME0 and OME1 are outcome regression estimates for farm and non-farm households.
SE: Standard Error

Table 7. Effect of non-farm employment on agricultural commercialization

Outcome variable	ATE	Robust Std. error	P value	ATET	Robust Std. error	P value
Cereals						
Total Sales (kg)	-789.98	101.91	0.000	-630.38	113.54	0.000
Marketed surplus (percent)	-8.89	0.46	0.000	-8.94	0.47	0.000
Pulses						
Total Sales (kg)	-6.76	6.73	0.315	-6.69	4.65	0.150
Marketed surplus (percent)	0.66	1.00	0.513	0.56	1.03	0.587
Oilseeds						
Total Sales (kg)	-56.50	26.13	0.031	-53.63	21.82	0.014
Marketed surplus (percent)	-2.42	1.11	0.029	-2.18	1.15	0.058

production) is shown in Table 7. We had shown both ATE and ATET coefficients with robust standard error and its significance. The study shows that non-farm income had a negative effect on commercialization. These are on par with the results of previous studies (Kan *et al.*, 2006; Woldeyohanes *et al*. 2015). These studies had shown that the additional income from non-farm employment is used for non-agricultural consumption (rather than investing in agriculture) and they move towards subsistence-based farming. This could be also due to the fact that the households engaging in non-farm income are poor and may be participating in wage labour with little savings Woldeyohanes *et al.* (2015). In our study, we explored the effects on different crop groups (cereals, pulses, and oilseeds). The results show that there are differential effects across those groups. Households engaged in non-farm activities are found to have a lesser quantity of sales and marketed surplus (percent). In case of cereals, the households engaged only in farm activities are on an average selling 789.98 kg (ATET: 630.38 kg) of produce more than non-farm households. While in pulses and oilseeds it was 6.76 kg (ATET: 6.69 kg) and 56.50 kg (ATET: 53.63 kg) respectively. A significant difference in total sales and marketed surplus (percent) was found in case of cereals and oilseeds. Even though the absolute measure (quantity sold) looks high the relative shares (percent) is roughly 9 percent in case of cereals and 2 percent in case of oilseeds. In case of pulses, the effect was found to be positive but insignificant.

CONCLUSIONS

The role of non-farm employment in the rural sector is growing in India. We used a national representative rural household level data collected by NSSO to understand the interaction between participation of household in non-farm activities and agricultural commercialization. We found that participation of household in non-farm activities had a negative relationship with agricultural commercialization. The effect on total sales of cereals and oilseeds was found to be negative. Empirical finding from our study suggests that households may not be investing their income from non-farm employment into agriculture to increase productivity and marketed surplus. There could be two plausible reasons, one is that they have little savings after the consumption left to invest into agriculture or they switch to the non-farm sector as their primary income source and practice agriculture at subsistence level (for self-consumption). Weighing on both possibilities it is more likely that households with alternative opportunities would remain as subsistence farmers or even move towards subsistence farming.

REFERENCES

Amare, M., & Shiferaw, B. (2017). Nonfarm employment, agricultural intensification, and productivity change: empirical findings from Uganda. *Agricultural Economics (United Kingdom)*, *48*, 59–72. http://doi.org/10.1111/agec.12386.

Government of India. (2010). *National accounts statistics, 2007.* Central Statistical Organization, Ministry of Statistics and Program Implementation, New Delhi

Jayne, T.S., Haggblade, S., Minot, N., & Rashid, S. (2011). *Agricultural commercialization, rural transformation and poverty reduction: What have we learned about how to achieve this?* Synthesis report prepared for the African Agricultural Markets Programme Policy Symposium, Alliance for Commodity Trade in Eastern and Southern Africa April 20-22, Kigali, Rwanda

Kan, I., Kimhi, A., & Lerman, Z. (2006). Farm output, non-farm income and commercialization in rural Georgia. *The Electronic Journal of Agricultural and Development Economics, 3*(2), 276–286.

Kaur, S., Kulkarni, V.S., Gaiha, R., & Pandey, M.K. (2010). Prospects of non-farm employment and welfare in rural areas. ASARC Working Paper, 1–25.

Ministry of Agriculture. (2010-11). *Agriculture Causes*. Agriculture Census Division, Department of Agriculture & Co-operation, Ministry of Agriculture, Government of India, New Delhi.

Muriithi, B.W., & Matz, J.A. (2015). Welfare effects of vegetable commercialization: Evidence from smallholder producers in Kenya. *Food Policy,* (50), 80-91.

Parida, J.K. (2015). Growth and prospects of non-farm employment in India: Reflections from NSS data Central University of Punjab, Bathinda, India. *The Journal of Industrial Statistics 4*(2), 154 – 168.

Pingali, P. (1997). From subsistence to commercial production system: The transformation of Asian agriculture. *American Journal of Agricultural Economics, 79*(2), 628–634.

Rubin, D. (2006). The use of matched sampling and regression

adjustment to remove bias in observational studies. In Matched Sampling for Causal Effects (pp. 81-98). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511810725.008,

The World Factbook. (2014). Central Intelligence Agency (CIA), USA. Retrieved from https://www.cia.gov/library/publications/download/download-2014/index.html

Woldeyohanes, T.B., Heckelei, T., & Surry, Y. (2015). Effect of off-farm income on smallholder commercialization: Panel evidence from rural households in Ethiopia. Presented at the *29th International conference of Agricultural Economists*, 8-14 August, Milan (Italy).

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 308-313
DOI: 10.5958/2322-0430.2018.00076.8

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Rural Indebtedness and Farm and Non-farm Credit

Pushpinder Jit Kaur and Anupama*

Research Scholar and Professor, Department of Economics, Punjabi University, Patiala-147002

**Corresponding author's email: pushpinder2409@gmail.com*

Received: January 01, 2018 *Manuscript Number: NS-18-76* *Revision Accepted: February 13, 2018*

ABSTRACT

The present paper attempts to analyse the extent of household indebtedness and utilisation pattern of credit in rural Punjab. In this context, unit level records of the nationally represented secondary data from the key indicators of all India Debt and Investment Survey of Rural Household in India (Punjab) has been used; that is being extracted and scrutinized from 70th round of National Sample Survey Office. The results of the study indicate that the informal mechanism of credit delivery is playing an important role for meeting their credit requirements in the State. It's also noteworthy that either the debt is provided by the institutional or non-institutional credit agencies, the crucial aspect of increasing indebtedness in rural area is mainly concerned with its lane of purposee. On the basis of foregoing analysis it is to be suggested that the credit supervisory mechanism of the financial institutions should be strengthened to tackle the problems of rural indebtedness.

Keywords
Credit, expenditure, indebtedness, interest, non-farm credit.

JEL Codes
C82, E43, E51, P24, P44.

INTRODUCTION

Rural indebtedness has its historical roots in the pre-colonial phase. Since that time, not only peasantry but agricultural labourers and other artisans also have been suffering from widespread indebtedness (Rao, 2009). Indebtedness can be associated with many problems such as poverty, high cost of production, low returns, unfavorable weather conditions, unproductive expenditure etc. Almost every state has been suffering from this evil which further causes economic as well as social distress among the rural households (Deshpande, 2002). Furthermore, farmers released by agricultural sector were not being absorbed outside. Another major issue is related with heavy farm investment and low level of savings among farmers and labourers. To fill that saving gap, they have to rely upon the access to loans and major part of that loan is used unproductively which pushessthe deeper into the debt trap (Singh & Toor, 2005).

The income of rural households did not have grown so high as to reduce their dependence on credit agencies. Along with this, the rise in the share of formal credit agencies in the total debt of rural households and fall in the share of debt for productive purposes leads them further to increased indebtedness. The farmers have no option to seek for informal credit which is more exploitative in nature and majority of the amount of loan is used unproductively, which is the major cause of declining productivity and accumulation of debt due to non-repayment of amount of loan (Sajjad & Chauhan, 2012). However, while borrowing money the borrower does not pay attention to his repaying capacity and for him even a little debt becomes a trap out of which he cannot come out. Rural borrowing and rural debt signify two different things. There is nothing wrong in borrowing especially when the funds are required for productive purposes but indebtedness arises when the income of the borrower is not sufficient to repay the debt incurred or when he spends his income for unproductive purposes and does not save for the purpose of paying off his debt. When the borrower fails to repay the loan in time and the loan goes on accumulating, he becomes indebted (Mishra, 2009). This is not the end of the story, further the burden of debt passes on from generation to generation. The number of those in the grip of this vicious problem is even now

very large, despite vigorous attempts to solve it. Rural indebtedness has eaten into the very vitals of our rural social structure. Hence it has drawn the attention of sociologists, economists, planners, bureaucrats, academician and others since long time in the past (Sarangi, 2011).

One of the important aspects of a loan is the purpose for which it is taken. This is because the loan taken and utilized for productive purposes such as capital or current expenditure in household enterprises (agricultural or non-agricultural) can be expected to accelerate the economic activity (Income Generating Activity) of the households and ultimately promote their economic welfare. Hence if a large number of households have taken loans for productive purposes it is a sign of flourishing economic activity in the society. On the other hand, purposes like meeting household expenditure, expenditure on litigation, repayment of debt, other financial investment expenditure, etc.(Non-income Generating Activities) may be considered as 'unproductive purposes' as the money spent on them neither results in production of goods and services nor brings any economic prosperity to the households. Such loans, if large or frequent, may lead to perpetual debt and misery. Any study of indebtedness, therefore, would be incomplete without knowledge of the distribution of debt according to different purposes. Therefore, the utilisation pattern of loan in which, the amount of debt outstanding corresponding to the distribution, as obtained from (NSSO, 2014), is presented in the present paper. In this prospective the present paper is having following objectives:

i. to examine the loan burden by source on rural households in the state of Punjab,
ii. to find out the outstanding loan for farm and non-farm activities by rate of interest in Punjab, and
iii. to know about the cash loan outstanding to different sources according to land holdings in Punjab.

METHODOLOGY

This paper is based on secondary data. The major source of data is unit level records of the 70th round of the NSSO 2014 (Key Indicators of All India Debt and Investment Survey). For analysis, simple averages and percentage share is used wherever necessary.

RESULTS AND DISCUSSION

Distribution of cash loan for each occupational category by its broad purpose is presented in the following segment of this paper. Here the households in the rural sector of Punjab are broadly classified as cultivator and non-cultivator households. Cultivator households are all households having operated area of land 0.002 hectare or more and non-cultivators are all the remaining households.

Table 1 depicts the percentage of cash loan outstanding by purpose of loan for each occupational category separately, for the year 2012. In the year 2022, it has been seen that among total amount of loan outstanding 73.60 percent is outstanding among cultivators and remaining 26.40 percent of the total loan outstanding is reported by non-cultivator households. Thus, all the households were reporting 95.77 percent loan outstanding against the total amount borrowed for the different purposes. Out of the total amount of loan outstanding, 60.77 percent of loan is outstanding against

Table 1. Percentage distribution of cash loan by purpose for each occupationalcategory as on 30.6.12

Purpose of loan	Percentage distribution of cash loan (outstanding)		Percentage share of cash loan outstanding	Percentage of cash loan outstanding to borrowings
	Cultivators	Non-cultivators		
Capital expenditure in farm business	95.14	4.86	27.34	129.15
Current expenditure in farm business	96.32	3.68	30.35	80.15
Expenditure in farm Bbusiness	95.76	4.24	57.70	97.72
Capital expenditure in Non-Farm business	12.20	87.80	1.50	80.85
Current expenditure in Non-farm business	94.08	5.92	1.57	110.56
Expenditure in Non-farm business	53.98	46.02	3.07	93.69
Income generating activities (IGA)	93.65	6.35	60.77	97.51
Repayment of debt	22.74	77.26	1.62	100.36
Financial investment expenditure	100.00	0.00	0.19	86.86
For education	56.46	43.54	0.00	100.00
For medical treatment	29.61	70.39	3.40	116.28
For housing	45.05	54.95	9.07	90.84
For other household expenditure	44.85	55.15	22.55	92.40
Others	38.28	61.72	2.39	81.33
Expenditure on households / Non-income	42.53	57.47	39.23	93.19
All	73.60	26.40	100.00	95.77

Source: All India Debt and Investment Survey (NSSO,2014).

productive activities and 39.23 percent of loan is outstanding against unproductive activities. When occupational category wise loan outstanding is calculated then it has been found that cultivators were reporting the major proportion of total loan is outstanding, which has been shared in the ratio of 93.65 percent of loan outstanding against IGA and 42.53 percent against NIGA. On the other hand, non- cultivator households have shown 26.40 percent of outstanding loan to the total loan outstanding, out of which 6.35 percent of loan were outstanding for IGA and 57.47 percent for NIGA. Furthermore, among unproductive nature of expenditure, the highest (22.55 percent) proportion of debt was outstanding for 'other household expenditure'. It has also been observed that the percentage of total amount of loan outstanding to the total amount of loan borrowed for different purposes from different credit institutions, for all the households of rural Punjab has shown more than hundred percent. Among both the purposes of loan, IGA reporting near hundred percent of loan outstanding to loan borrowed (97.51 percent) and 95.77 percent of loan was outstanding against the amount of loan borrowed for NIGA. It has been found that among sub categories of the IGA and NIGA, in many cases the amount of loan outstanding against amount of loan borrowed is more than hundred percent.

Utilisation Pattern by Source of Credit

While calculating the cash loan outstanding over different purposes of loan, it is also very important to look at their sources from where households avail loan for fulfilling their credit needs. Among this, the *institutional* credit agencies play an important role in meeting the need of credit of the households on easy terms of contract and thus reduce the burden of heavy interest that the households would otherwise be compelled to bear. Unfortunately, along with this, their prevalence appears to be the least among those, who probably, need their services the most and are forced to move towards non-institutional credit agencies, which also charge exorbitant rate for providing credit to the households. Thus, this section of paper also found debt burden of rural households in the state of Punjab along with the utilization pattern by source of credit and findings are revealed by Table 2.

Table 2 shows the utilization pattern along with disbursement of loan and cash loan outstanding to institutional and non- institutional credit over purpose of loan as on 30.06.2012. It has been observed that 62.88 percent of the total loan is provided by institutional credit agencies and remaining 37.12 percent of loan is provided by non- institutional credit agencies, while in case of cash loan outstanding these proportions were found 60.58 percent and 39.42 percent of the respective credit agencies. While finding purpose of use of institutional and non- institutional credit, it has been observed that 59.68 percent of total loan was borrowed for IGA and

Table 2. Distribution of cash loan outstanding by purpose and sourceas on 30.06.2012

Purpose of loan	Share of loan	Institutional		Non-institutional	
		Percentage share of borrowing	Percentage share of loan outstanding	Percentage share of borrowing	Percentage share of loan outstanding
Capital expenditure in farm business	20.28	84.21	87.40	15.79	12.60
Current expenditure in farm business	36.27	79.79	74.95	20.21	25.05
Expenditure in farm business	56.55	81.37	80.85	18.63	19.15
Capital expenditure in Non-farm business	1.78	82.70	80.27	17.30	19.73
Current expenditure in Non-farm business	1.36	20.30	15.26	79.70	84.74
Expenditure in non-farm business	3.14	55.72	47.10	44.28	52.90
Income generating activities (IGA)	59.68	80.03	79.14	19.97	20.86
Repayment of debt	1.55	0.76	0.77	99.24	99.23
Financial investment expenditure	0.21	48.86	48.02	51.14	51.98
For education	0.00	0.00	0.00	100.00	100.00
For medical treatment	2.82	35.45	20.11	64.55	79.89
For housing	2.80	26.43	26.78	73.57	73.22
For other household expenditure	9.56	52.92	44.88	47.08	55.12
Others	23.37	35.09	30.68	64.91	69.32
Expenditure on households/ Non-income generating activities (NIGA)	40.32	37.50	31.83	62.50	68.17
All	100.00	62.88	60.58	37.12	39.42

Source: All India Debt and Investment Survey (NSSO, 2014).

remaining part of loan (40.32 percent) for NIGA. Furthermore, examining activity-wise utilization of the loan, we can see that the usage of loan for income generating activities is quite high, that is, as high as 80.03 percent provided by formal sources of finance and non-institutional sources of credit provide remaining proportion of loan (19.97 percent). Among all the income generating activities, nearly three fourth of the loan from the formal agencies were found to be used for ccapital expenditure on farm business and non- farm business. Here we can see that the formal sector also plays an important role in financing 37.50 percent of the total loan distributed for NIGA and reporting 31.83 percent loan outstanding for the same purpose of loan. On the other hand, higher proportion of loan (62.50 percent) and 68.17 percent of loan outstanding were found for NIGA, sourced by informal sector. When it is further elaborated then it has been seen that among non-income generating activities, repayment of previous debt, education, household expenditure, other unproductive purposes and financial investment expenditure category took major share of their respective loans provided by formal sector for these purposes. It has been found that formal credit agencies provide more proportion of loan for productive use and lesser for unproductive use, contrary to this informal credit agencies provide less proportion of loan for productive use and higher proportion of loan for unproductive purpose.

Source and Utilisation of Credit according to Rate of Interest

The actual rate of interest largely explains the interest burden to be borne by the indebted households. Hence in order to understand the burden of interest amount, the actual rate of interest (henceforth referred to as ROI) has also be examined according to rate of interest charged by different sources of credit. It mmight be noted in this connection that in case a household has taken many loans from different credit institutions at different rate of interest, it has been counted separately for each of the relevant categories of loan. However, at the time of borrowings, rate of interest at which credit is available plays an important role. Therefore source and purpose-wise distribution of loan according to different interest rates is shown in Table 3.

The perusal of Table 3reveals the percentage distribution of total amount of cash loan on 30.06.2012 by rate of interest separately for institutional and non-institutional agencyes and correspondingly by purpose of loan. It has been observed that the share of institutional sources has been higher than the non-institutional ones up to 15 percent rate of interest and for the rate of interest higher than 15 percent, the share of non-institutional agencies turns out to be higher than the institutional agencies. Thus the institutional agencies have been found to play a significant role in providing credit to the households with a moderate rate of interest. It has been observed that whole of the interest-free loan has been

Table 3. Distribution of credit for different purposes by rate of interest, as on 30.6.12

(Percent)

Rate of interest	Source of credit		Purpose of loan	
	Institutional	Non-institutional	IGA	NIGA
Nil	0	100	4.14	95.86
<6	73.72	26.28	72.17	27.83
6 - 10	98.51	1.49	79.56	20.44
10 - 12	88.05	11.95	64.85	35.15
12 - 15	93.29	6.71	69.56	30.44
15 - 20	65.21	34.79	59.44	40.56
20 - 25	9.27	90.73	51.06	48.94
25 - 30	8.90	91.10	25.21	74.79
> 30	9.78	90.22	15.62	84.38
All	63.40	36.60	59.68	40.32

Source: All India Debt and Investment Survey (NSSO, 2014).
IGA: Income Generating Activities.
NIGA: Non-Income Generating Activities.

taken from the non-institutional agencies. It is due to the reason that the only source of loan was relatives and friends. For rest of the categories, during 2012, the share of institutional agencies for interest categories 6-10, 10-12, 12-15, and 15-20 percent was 98.51, 88.05, 93.29, and 65.21 percent, respectively. On the other hand, the non-*institutional* agencies provide a significant amount of total loan to households in the case of interest categories greater than 20 percent. The share of non-institutional agencies in the interest categories 20-25, 25-30 and more than 30 percent has been found to be about 90.73, 91.10, and 90.22 percent, respectively. It has also been observed that highest share of interest-free loan (95.86 percent of loan) is used for non income generating activities. Interestingly, for lower rate of interest categories wherethe share of institutional agencies is higher than the non-institutional ones, the share of IGA is also higher than the NIGA. In interest categories greater than 30 percent, the credit is biased towards NIGA only. In this category, the share of NIGA has been found to be 84.38 percent. In order to check the change in debt pattern according to the rate of interest charged by different credit agencies on rural borrowings during 2012, study includes distribution of credit by credit agencies for different purposes for the year 2012, which is presented in the next Table.

Table 4 depicts the percentage of cash loan outstanding against the total amount of cash loan borrowed on 30.06.2012 by rate of interest separately for institutional and non-institutional agency and for different purposes of loan. While analyzing the loan borrowed and loan outstanding for the year 2012, similar trends could have been noticed regarding the purpose-wise and source-wise distribution of the loan outstanding for different interest categories. Again in case of loan outstanding, it has been observed that the proportion of

Table 4. Percentage of cash loan outstanding for different purposes by rate of interest, as on 30.6.12

(Percent)

Rate of interest	Source of credit		Purpose of loan	
	Institutional	Non-institutional	IGA	NIGA
Nil	0	100	4.83	95.17
<6	78.49	21.51	78.69	21.31
6 - 10	98.92	1.08	80.26	19.74
10 - 12	84.98	15.02	69.72	30.28
12 - 15	93.82	6.18	79.02	20.98
15 - 20	63.30	36.70	55.57	44.43
20 - 25	9.76	90.24	48.69	51.31
25 - 30	7.92	92.08	22.99	77.01
>30	8.30	91.70	11.86	88.14
All	60.58	39.42	60.77	39.23

Source: All India Debt and Investment Survey (NSSO, 2014).
IGA: Income Generating Activities.
NIGA: Non-Income Generating Activities.

outstanding loan for institutional sources has also been higher than the non-institutional ones up to 15 percent rate of interest and for the rate of interest higher than 15 percent, the proportion of loan outstanding for non-institutional agencies turns out to be higher than the institutional agencies. As observed in table 3, the institutional agencies have been found to play a significant role in providing credit to the households and at the same time showing similar trend regarding the loan outstanding with a moderate rate of interest. During the same period of time, the proportion of loan outstanding against institutional agencies for interest categories 6-10, 10-12, 12-15, and 15-20 percent was 98.92, 84.98, 93.82, and 63.30 percent, respectively. On the other hand, the non-institutional agencies were found to provide a significant amount of total loan to households (Table 3) in the case of interest categories greater than 20 percent. The proportion of loan outstanding for non-institutional agencies in the interest categories 20-25, 25-30 and more than 30 percent has been found to be about 90.24 percent, 92.08 percent and 91.70 percent, respectively. It has also been observed that highest share of interest-free loan (95.17 percent of loan) is outstanding for non-income generating activities. Interestingly, for higher rate of interest categories, the loan outstanding for non-institutional agencies is higher than the institutional ones; the proportion of the same for NIGA is also higher than the IGA. In interest categories greater than 30 percent, the proportion of loan outstanding for NIGA has been found to be 88.14 percent. So unproductive usage of usurious loan makes the situation more critical for the households and traps them into vicious circle of debt.

Table 5 presents the percentage share of distribution of cash loan by purpose of loan across landholding class of households for the year 2012. With the objective of condensing the results and focusing was on the major features; purposes relating to income generating activities and non- income generating activities. It has been observed that households of the lower land holdinggroups incurred relatively small part of their debt for productive purposes. It can be observed that in the total share of loan more than 19 percent share of the total borrowings were used by the households fall under 0.01-1.00 hectares of land holdings categories taken together and furthermore, another 38 percent of borrowings were utilized by the households owning 1.01 - 4.00 hectares of land holdings. Remaining 43 percent of the total borrowings were acquired by the households having 4.01 - 10.00 hectares and more of land holdings in 2012. It was also observed that households of the lower land holdinggroups incurreda relatively small part of their debt for productive purposes, contrary to this; households with large size of land holdings used higher proportion of loan productively. The percentage share of debt for productive purposes were seen to have increased from 20.05 percent

Table 5. Percentage share of distribution of cash loan by purpose of loan for each landholding class as on 30.6.12

(Percent)

Area operated (in 0.000 hectare)	Share of loan	IGA		NIGA	
		Borrowings	Cash loan outstanding	Borrowings	Cash loan outstanding
< 0.01	2.55	20.05	22.36	79.95	77.64
0.01 - 0.40	7.90	50.00	50.00	50.00	50.00
0.41 - 1.00	8.95	65.46	75.19	34.54	24.81
1.01 - 2.00	10.81	47.98	41.82	52.02	58.18
2.01 - 4.00	27.45	89.93	91.36	10.07	8.64
4.01 - 10.00	30.95	79.98	85.13	20.02	14.87
> 10.00	11.38	99.60	99.38	0.40	0.62
All	100	59.68	60.77	40.32	39.23

Source: All India Debt and Investment Survey (NSSO, 2014).
IGA: Income Generating Activities.
NIGA: Non-Income Generating Activities.

in the bottomlandholding class (upto< 0.01 hectare) to 99.60percent in the top landholdingclass (> 10.00 hectare and above). Furthermore, an inverse situation has been seen in percentage share of debt for unproductive purposes, as it has declined from 79.95 percent to 0.40 percent for the respective bottom to top landholding class. Along with the percentage of cash loan outstanding other variables like share of loan taken by each landholding class, amount of cash loan outstanding and its percentage corresponding to borrowings are equally important. Similar trends could have been noticed regarding the purpose-wise distribution of the loan outstanding across different size of land holdings. It has also been found that the households with large land holdings uses large amount of loan for productive purposes and households with small land holdings uses large amount of loan for unproductive purposes.

CONCLUSIONS

Nowadays, rural indebtedness is becoming an obstacle and impediment for rural development. In the present paper we have observed that on an average, the rural households raised 62.30 percent of the total loans for IGA while 37.70 percent was raised for the NIGA in 2012. In 2012, it has been found that among the non-income generating activities, the share of institutional loan is higher for household expenditure and expenditure on education. For rest of the NIGA, the main has been found to be non-institutional agencies. Hence, in order to understand the burden of interest amount, the actual rate of interest (henceforth referred to as ROI) has also been examined according to the sources of credit. It might be noted in this connection that in case a household has taken many loans from different credit institutions at different rate of interest, it has been counted separately for each of the relevant categories of loan. It has been *observed that whole of the* interest-free loan has been taken from the non-*institutional* agencies. It is due to the reason that the only source of loan was relatives and friends. In both the time periods, it has been observed that the share of institutional sources has been higher than the non-institutional ones up to 15 percent rate of interest and for the rate of interest higher than 15 percent, the share of non-institutional agencies turns out to be higher than the institutional agencies. Similar trends could have been noticed regarding the purpose-wise and source-wise distribution of the loan outstanding for different interest categories. We have also been observed largely a direct relation between size of land holdings and utilization of loan for productive purposes in both the time periods. As we have seen that the households with small land holding should spend large share of loan on non-farm activities (NIGA), larger proportion of which is availed from informal sector of credit, therefore, government and financial institutions should make available the appropriate delivery of credit into the agricultural as well as non-agricultural sector of rural sector, especially to the households with small land holdings. It has been observed that the rural household indebtedness is somewhere related with the unproductive use of loan, which is responsible for the poor conditions of the cultivators and non-cultivators, living in rural areas of Punjab. So, along with curbing the exploitative mechanisms of the informal agencies, there is also a need to increase the awareness among rural households in general and agricultural households in particular, about the disadvantages of utilization of loan in unproductive activities.

REFERENCES

Deshpande, R.S. (2002). Suicide by farmers in Karnataka, agrarian distress and possible alleviatory steps. *Economic and Political Weekly, 37*(*26*), 2601-2610.

Mishra, S. (2009). *Agrarian distress and farmers' suicides in Maharashtra, agrarian crisis in India.* London: Oxford University Press.

NSSO. (2014). *Key indicators of debt and investment in India*, 2013. New Delhi: National Sample Survey Organization.

Rao, P.V. (2009). New insight into the debates on rural indebtedness in 19th Century Deccan. *Economic and Political Weekly, 44*(4), 55-61.

Sajjad, H., & Chauhan, C. (2012). Agrarian distress and indebtedness in rural India: Emerging perspectives and challenges ahead. *Journal of Geography and Regional Planning, 5*(15), 397-408.

Sarangi, T.K. (2011). *Rural indebtedness and practices of MFIs in Andhra Pradesh*. Lucknow: Centre for Microfinance Research Bankers Institute of Rural Development.

Singh, S., & and Toor, M.S (2005). Agrarian Crises with special references to Indebtedness among Punjab Farmers. *Indian Journal of Agriculture Economics. 60*(*3*), 335- 346.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 314-323
DOI: 10.5958/2322-0430.2018.00077.X

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Indebtedness among Rural Households –A Case for Bathinda district of Punjab

Rupinder Kaur and Gagandeep Kaur*

Assistant Professor and Research Scholar Department of Economics, Punjabi University, Patiala-147002

**Corresponding author's email: rupinderkaur0076@gmail.com*

Received: January 07, 2018 *Manuscript Number: NS-18-81* *Revision Accepted: March 10, 2018*

ABSTRACT

The present paper is an attempt to assess and analyses the debt position of rural households of Bathinda District of Punjab. The study reveals that 81.18 percent of the rural households are under debt in Bathinda District. The average amount of debt per household is the highest for farm households and the lowest for other households. Source wise, agricultural labour, non-agricultural labour and artisan households have similarities in pattern. For these households, major sources of debt are the large farmers, traders and commission agents. For the farm households, the major sources of debt are the commercial banks, co-operative banks and commission agents. The farm households availed loans mainly for the purchase of farm inputs and mechanical equipments. The agricultural labour, non-agricultural labour, artisan and other households have availed the maximum proportion of the total debt for family maintenance expenditure. The farm households and the other households have availed the maximum amount of debt at lower rates of interest but, the agricultural labour, non-agricultural labour and artisan households have availed the maximum amount of debt at higher rates of interest. These households are still depending upon non-institutional sources which charge exorbitant rates of interest. The estimates of regression coefficient suggest that the variations in the magnitude of indebtedness of the rural households are explained to a large extent by the ratio of credit from the non-institutional sources, family size, income from subsidiary occupations and farm-size. The contribution of these explanatory variables is statistically significant.

Keywords
Rural households, total debt, sources, purposes, determinants.

JEL Codes
B1, E43, G21, G23, Q12.

INTRODUCTION

The urban population has been increasing rapidly, but still, 68.84 percent of our population is rural. Although agricultural is the backbone of the Indian economy, yet it has always been a way of life rather than a business in India (Kumar, 1993). Agricultural sector contributed 17.4 percent of India's gross domestic product (GDP) in 2015-16, as compared to 18.3 percent in 2013-14 (Government of India, 2016). Agricultural sector plays a vital role in employment generation in Indian economy with nearly half of the Indian population being dependent on agricultural and allied activities for livelihood. About 49 percent of the total workforce is still engaged in farming and allied activities (NSSO, 2014).

Punjab is an agricultural developed state of India. In mid-1960, there are significant structural changes in the Punjab economy. The adoption of new technology, consisting of hybrid seeds, chemical fertilizers, insecticides, pesticides, herbicides and modern practices set Punjab agricultural on a new path (Sidhu, 2002). The agricultural policy that ensured easy access to inputs through credit and subsidies and an assured market through Minimum Support Prices helped successfully translate the new technology into increasing agricultural production. Due to the green revolution subsistence agricultural moves on to the modern and commercial agriculture. In October 1965, the new policy was put into practice when 114 districts (out of 325) were selected for an Intensive Agricultural Area Programme (IAAP) which emphasized the essential of providing the cultivator with a complete "package of practices" in order to increase yields, including credit, modern inputs, price incentives,

marketing facilities and technical advice (Frankel,1971). The expenditure on modern inputs has been steadily growing because new technology requires huge amounts of investment which can be only afforded by the large farmers. So, most of the small and marginal farmers cannot afford heavy investment out of their own funds. The benefits of new agricultural technology in agriculture are mainly restricted to the farmers with larger holding and those with smaller holdings still continue to have traditional methods of cultivation, because they are unable to make heavy investments. Increase in population has caused more sub-division of landholdings, which has further increased the number of marginal and small farmers. The demand for the labour in the agricultural sector has adversely affected due to the use of technology and machinery. So that they can decline the proportion of workforce of the state and that has added to unemployment and semi-employed (Singh & Bhogal, 2014).

The share of agriculture in GSVA at constant prices has declined from 19.73 percent in 2011-12 to 15.60 percent in 2016-17. The share of primary sector which includes agriculture and livestock has come down from 30.81 percent in 2011-12 to 25.84 percent in 2016-17 (Government of Punjab, 2016). The agriculture sector in the state is showing signs of a serious slowdown over the past few years. The sector's growth rate has shown cyclical trend. It declined by 6.76 percent in 2014-15 as per provisional estimates and is likely to decline further by 0.64 percent during 2015-16 as per quick estimates. The growth on an average basis in agriculture sector is slowing down over the years as cropping intensity and irrigation potential have already been fully exploited and the growth in productivity has also reached a saturation point as very few R&D advances have taken place over a long period of time (Government of Punjab, 2016a).

Green Revolution sustained till the eighties, after which the agricultural production in the state showed the signs of stagnation. Agricultural growth has been declined since the mid-nineties. The state has experienced deceleration of its economy and has slipped in the ranking of the prosperous states in the country (Singh & Bhogal, 2014). The state of Punjab, earlier regarded as an agriculturally developed region of India, has been passing through a several economic crisis (Singh, 2014). It has been found that since the early 1990s, the yield of major agricultural crops has been experiencing stagnation. The additional increments in yield are rising at a very high marginal cost. As a consequence, per hectare, net return is declining and this is the real crisis of Punjab agriculture (Ghuman, 2008).

One major factor to which this high unpredictability may be attributed is the continued dependence on the vagaries of the monsoon. But the uncertainty in earnings from agricultural operations, along with the increasing dependence on purchased inputs, means a higher level of borrowing including borrowing from informal sources (Path, 2008).The institutional lending was inadequate and cumbersome and farmers have to resort to private non-institutional sources of finance which have their own ways to exploit and squeeze the farmer's income (Kaur *et al*., 2016).

Since mid-1980s, suicides by cultivators and agricultural labourers have reported in Punjab. Under economic and social stress, and the non-existence of informal social support mechanisms caused many poor peasants and agricultural labourers are committed suicides in past years and still continue. A recent state wide survey conducted by economics departments of various universities of Punjab reveals that in every two days three farmers commit suicides due rising indebtedness. The gravity of the problem as well as its causes pointed out the most of the suicide victims were small and marginal farmers and labour households. Suicides were attributed to a number of reasons, ranging from poverty to crop failure, indebtedness, but in our view it was mainly due to the economic crisis that the peasantry, in the state in Punjab, in general, is facing and which has led them to borrow heavily (Gill & Singh, 2006). The incapability of farmer and agricultural labourers to pay-off loans is the major cause of suicides. The Central Government is providing several forms of assistance to the farmers, but the most of the farmers are disadvantaged of these assistance due to the lack of effectiveness of these schemes. So far there is no improvement in the plight of the farmers and the suicides are continued (Jeromi, 2007).

Within this general context of agrarian crisis, our paper makes an effort to estimate the extent and distribution of indebtedness among different categories of rural households according to source, rate of interest and purpose of indebtedness among the rural households of Bathinda District. An attempt has also been made to identify economic factors influencing among the rural households of Bathinda District.

RESEARCH METHODOLOGY

There are three tehsils in Bathinda district. For the purpose of this study, one village from each tehsil has been selected on random basis. Thus, in all, three villages have been selected from the district for the survey. A representative proportional sample of all households comprising farmers, agricultural labourer, non-agricultural labour, artisan and other households have been taken up of the survey. As many as 10 percent households out of total households are selected for survey on random basis. As a result, total 220 households have been investigated. Out of 220 households, 131 households belong to farmers, 51 households belong to agricultural labour, 16 households belong to non-agricultural labour, 11 households belong to artisan and 11 households belong to other households.

Functional Analysis: It is important to study the factors associated with indebtedness. Linear regression has been used to analyze the relative indebtedness of different

categories of rural households in the Bathinda District as given below:

$Y = f((X_1, X_2, X_3, X_4, X_5, X_6)$

Where Y= Indebtedness (₹)

X_1= Family size

X_2= Ratio of credit from non-institutional sources to that from total debt

X_3= Income from subsidiary occupations other than the main occupation (₹)

X_4= Expenditure on unproductive purposes (₹)

X_5= Education level of head of household

X_6= Farm-size (acres)

RESULTS AND DISCUSSION

Extent and Distribution of Indebtedness

The extent and distribution of debt among the different categories of rural households is shown in Table 1. The results show that 81.18 percent of the total rural households are under debt. This percentage is 83.96 percent for the farm households, 90.19 percent for the agricultural labour households, 81.25 percent for the non-agricultural labour households, 81.82 percent for the artisan households and 45.45 percent for the other households.

The average amount of loan per sampled household is₹326677.24 in the rural areas of Bathinda district. The average amount of loan per sampled household is the highest (₹493007.6) for the farm households. The amount of loan is ₹108437.5, ₹85000, ₹78636.36 and ₹31818.18 for the non-agricultural labour, agricultural labour, artisan and other households, respectively. The average amount of loan per indebted household for an average rural household is ₹392726.27.The amount of loan per indebted household is ₹587127.27 for the farm households, ₹94239.13 for the agricultural labour households, ₹133461.54 for the non-agricultural labour households, ₹96111.11 for the artisan households and ₹70000 for the other households.

Indebtedness According to the Source of Debt

The rural households take debt from both the institutional and non-institutional sources. The institutional sources include co-operative credit societies/banks, commercial banks and regional rural banks etc. and non-institutional sources include money-lenders, commission agents, traders, large farmers, relatives and other sources. The data highlighting the role of various sources of debt in the study area is presented in Table 2. The table demonstrates that an average sampled rural household has taken ₹177172.7 from the institutional agencies while ₹149504.54 from the non-institutional agencies. In case of institutional sources, the commercial banks are the main source of debt. In case of non-institutional sources the commission agents, others, and large farmers are the main sources of credit for rural households.

The farm households have incurred ₹306671.76 from the institutional sources while ₹186335.88 from the non-institutional sources. The farm households mainly prefer commercial banks. The agricultural labour households are indebted to the extent of ₹77568.63 to the non-institutional agencies and ₹7431.37 to the institutional agencies. The non- agricultural labour households are indebted to the extent of ₹19686.5 to the institutional agencies and ₹88750 to the non-institutional agencies. The artisan households have taken ₹ 37272.73 from the institutional sources and ₹41363.63 from the non-institutional sources. The other households have taken the whole amount of loan from the institutional sources. Thus, here this fact is established that agricultural labour, non-agricultural labour and artisan households find it easy to get loans from private agencies and they hesitate to take loans from institutional agencies because of the time-consuming formalities, regulations and burdensome procedures and lack of collateral assets.

The proportionate shares of different credit agencies in total debt are given in Table 3. The table shows that an average sampled household has taken 57.93 percent of the total debt from the institutional sources. This proportion is 62.21, 47.4, 18.16 and 8.75 percent respectively for the farm, artisan, non-agricultural labour and agricultural

Table 1. Extent of debt among sampled households

Particulars	Farm households	Agricultural labour households	Non-agricultural labour households	Artisan households	Other households	All sampled households
Number of sampled household	131	51	16	11	11	220
Indebted households	110	46	13	9	5	183
Percentage of indebted households	83.96	90.19	81.25	81.82	45.45	81.18
Amount of debt (₹) per indebted households	587127.27	94239.13	133461.54	96111.11	70000	392726.27
Amount of debt (₹) Per sampled household	493007.6	85000	108437.5	78636.36	31818.18	326677.24

Source: Field Survey, 2015-16.

labour households. Remaining 42.07 percent of the total debt has been taken from the non-institutional sources. This proportional share is 91.25 and 81.86 percent for the agricultural labour and non-agricultural labour households, respectively. An average sampled rural household has taken about 51 percent of the total debt

Table 2. Debt incurred from different credit agencies

(Mean Values, in ₹)

Source of debt	Farm households	Agricultural labour households	Non-agricultural labour households	Artisan households	Other households	All sampled
Institutional						
Co-operative credit societies/ bank	32862.6	0.00	0.00	0.00	0.00	19568.18
Commercial banks	271900.76	7431.37	5624	5454.55	27272.73	165672.7
Regional rural banks	1908.40	0.00	14062.5	31818.18	4545.46	3977.27
Sub-total	306671.76	7431.37	19686.5	37272.73	31818.19	177172.7
Non- institutional						
Money lenders	2404.58	0.00	0.00	0.00	0.00	1431.82
Traders	6870.23	9901.96	10312.5	6818.18	0.00	6386.36
Commission agents	115038.17	705.88	0.00	0.00	0.00	68663.64
Large farmers	381.68	64019.61	47187.5	34545.45	0.00	20227.28
Relatives & friends	3282.44	2941.18	31250	0.00	0.00	4909.09
Others	58358.78	0.00	0.00	0.00	0.00	34750
Sub-total	186335.88	77568.63	88750	41363.63	0.00	149504.54
Total	493007.6	85000	108436.5	78636.36	31818.19	326677.24

Source: Field Survey, 2015-16.

Table 3. Debt incurred from different credit agencies

(Percentage of total debt)

Source of debt	Farm households	Agricultural labour households	Non-agricultural labour households	Artisan households	Other households	All sampled households
Institutional						
Co-operative credit societies /Banks	6.67	0.00	0.00	0.00	0.00	5.99
Commercial banks	55.15	8.75	5.18	6.94	85.72	50.71
Regional rural banks	0.39	0.00	12.96	40.46	14.28	1.23
Sub-total	62.21	8.75	18.16	47.4	100	57.93
Non- institutional						
Money-lenders	0.49	0.00	0.00	0.00	0.00	0.44
Traders & shopkeeper	1.39	11.65	9.56	8.67	0.00	1.95
Commission agents	23.33	0.83	0.00	0.00	0.00	21.35
Large farmers	0.08	75.31	43.51	43.93	0.00	6.19
Relatives & friends	0.67	3.46	28.81	0.00	0.00	1.50
Others	11.83	0.00	0.00	0.00	0.00	10.64
Sub-total	37.8	91.25	81.86	52.6	0.00	42.07
Total	100	100	100	100	100	100

Source: Computed from Table 2.

from commercial banks. The others and farm households have taken 85.72 and 55.15 percent respectively of the total debt from this source.

An average rural household has incurred 21.35 percent of the total debt from commission agents. The other sources come at next rank from which an average sampled rural household has obtained 10.64 percent of the total debt. This proportional share is 11.83 percent for the farm households. The large farmers are another important source of non-institutional debt from which an average sampled rural household has taken about 6.19 percent of the total debt. This percentage is as high as 75.31 percent, 43.51 percent, and 43.93 percent, respectively for the agricultural labour, non-agricultural labour, and artisan households. About 6 percent of the total debt has been incurred from co-operative credit societies/banks. Only the farm households have taken 6.67 percent of the total debt from this source. The share of traders and shopkeeper in the total debt is 1.95 percent in the total debt. The share of relatives and friends in the total debt is 1.50 percent for an average sampled rural household. This percentage is the highest for non-agricultural labour households and the lowest for the farm households. The share of regional rural banks in the total debt is 1.23 percent for an average rural household. The artisan households have taken 40.46 percent of the total debt from the regional rural banks.

The above analysis clearly brings out the fact that the farm and other households have taken debt mainly from the institutional agencies. The artisan, agricultural labour,and non-agricultural labour households have taken debt mainly from the non-institutional agencies. For these households, major sources of debt are large farmer, traders and shopkeepers and other sources.

Indebtedness According to the Purpose of Debt

It is important to study the purposes for which the debt has been taken while analyzing indebtedness among the rural households. It is an important indication of its potential to be repaid. The information about debt incurred for various purposes is given Table 4. The table shows that the maximum amount of debt is availed by the rural households to purchase the farm inputs. An average sampled rural household incurs ₹98109.09 for this purpose. The farm households spent the highest amount on the purchase of farm inputs. Next important purpose for debt is family maintenance expenditure. The farm households have taken ₹103740.46 for the family maintenance. An average sampled rural household incurs ₹74881.82 for the family maintenance expenditure. The agricultural labour, non-agricultural labour, artisan and other households have taken ₹30862.75, ₹51562.5,

Table 4. Debt incurred for different purposes

(Mean values, in ₹)

Purpose of debt	Farm households	Agricultural labour households	Non-agricultural labour households	Artisan households	Other households	All sampled households
Purchase of farm inputs and mechanical equipments	164763.36	0	0	0	0	98109.09
Expenditure on education	76106.87	8039.22	6250	11818.18	1818.18	48318.18
House construction, addition of rooms and major repairs	5343.51	4313.72	11250	7272.73	2727.27	5500
Family maintenance expenditure	103740.46	30862.75	51562.5	25909.09	18181.82	74881.82
Expenditure on health care	11679.39	11705.88	7812.5	14545.43	7272.73	11054.55
Purchase of milch cattle	30954.20	14705.88	16250	4545.45	1818.18	23613.64
Marriages and other socio-religious ceremonies	74427.48	10960.78	15312.5	9090.91	0	48427.27
Redemption of old debts	10725.19	3921.57	0	0	0	9477.27
Others	15267.18	490.20	0	5454.55	0	9477.45
Total	493007.6	85000	108437.5	78636.36	31818.18	326677.27

Source: Field Survey, 2015-16.

₹25909.09 and ₹18181.82, respectively for the family maintenance. An average sampled rural household incurs ₹48427.27 for the marriages and other socio-religious ceremonies. The farm households have taken ₹74427.48 for this purpose. The other households have taken ₹9090.91 for this purpose.

Fourth rank goes to the expenditure on education and an average sampled rural household has availed a debt of₹48318.18 for this purpose. The farm households have taken the highest amount for this purpose followed by the agricultural labour, non-agricultural labour, artisan, and other households. A small amount of debt is used for health care, redemption of old debts and other purposes.

The farm households have taken loans mainly for the purchase of farm inputs. The agricultural labour, artisan, other and non-agricultural labour households have taken loans mainly for the family maintenance expenditure.

The proportionate shares of debt taken for different purposes are presented in Table 5. Among different purposes, the highest proportion goes to the purchase of farm inputs. About 30.03 percent of the total debt is spent on the purchase of farm inputs. The farm households spent the highest (33.42 percent) proportion of total debt on the purchase of farm inputs and mechanical equipments. An average sampled rural household has taken 22.92 percent of the total debt for the family maintenance expenditure. This proportion is as high as about 48 percent, 40 percent, 36.46 percent, about 33 percent, and 21.04 percent for the non-agricultural labour, other, agricultural labour, artisan and farm households, respectively. An average sampled rural household has spent 14.82 percent of the total debt for the expenditure on marriages and other socio-religious ceremonies. This proportion is as high as 15.10 percent for the farm households followed by the non-agricultural labour, agricultural labour, artisan and other households. The fourth main purpose of debt is education, which accounts for 14.79 percent of the total debt of an average sampled rural household. This proportional share is highest (15.44 percent) for the farm households followed by the agricultural labour, artisan, non-agricultural labour and other households.

An average rural household have incurred 3.38 percent of the total debt for the expenditure on health care. This proportion is the highest for the other households followed by the artisan, agricultural labour, non-agricultural labour and farm households. All the categories have taken very little share of total debt for the house construction, addition of rooms and major repairs, other purpose and redemption of old debts. The farm households have taken the debt mainly for the purchase of farm input. The agricultural labour, non-agricultural labor, artisan and other households have taken the debt mainly for the family maintenance expenditure. The

Table 5. Debt incurred for different purposes

(Percentage of total debt)

Purpose of debt	Farm households	Agricultural labour households	Non-agricultural labour households	Artisan households	Other households	All sampled households
Purchase of farm inputs and mechanical equipments	33.42	0.00	0.00	0.00	0.00	30.03
Expenditure on education	15.44	9.44	5.76	15.03	8	14.79
House construction, addition of rooms and major repairs	1.08	5.06	10.37	9.25	12	1.68
Family maintenance expenditure	21.04	36.46	47.55	32.95	40.00	22.92
Purchase of milch cattle	6.28	17.26	14.99	5.78	8.00	7.23
Expenditure on health care	2.37	13.74	3.46	18.50	32.00	3.38
Marriages and other socio-religious ceremonies	15.10	12.87	9.22	11.56	0.00	14.82
Redemption of old debts	2.18	4.60	0.00	0.00	0.00	2.23
Others	3.10	0.58	0.00	6.94	0.00	2.90
Total	100	100	100	100	100	100

Source: Computed from Table 4.

annual consumption expenditure of these categories of rural households far exceeds their annual income. So, to maintain the minimum level of consumption, they frequently resort to borrowing mainly for consumption purposes.

Indebtedness and Rate of Interest

The mean values of debt according to rate of interest are exhibited in Table 6. The table shows that an average sampled household in the rural areas of Bathinda district has availed maximum amount of debt at the rate of interest ranging between 15 to 21 percent per annum followed by the 1 to 7 percent, 8 to 14 percent, 21 to 28 percent and above 29 percent ranges of rate of interest. The farm households have taken ₹117419.8 at the rate of interest ranging between 1 to 7 percent, ₹108771 at the rate of interest ranging between 8 to 14 percent, ₹212389.3 percent at the range of 15 to 21 percent, ₹ 51145.04 percent at the range of 21 to 28 percent per annum and ₹3282.44 at zero percent rate of interest.

The agricultural labour households have taken ₹32411.76 at the rate of interest ranging between 15 to 21 percent, ₹19019.6 at the rate of interest ranging between 1 to 7 percent, ₹20000 at the rate of interest ranging above between 29 percent, ₹9843.14 at the rate of interest ranging between 8 to 14 percent, ₹2941.18 at zero rate of interest and ₹784.31 at the rate of interest ranging between 21 to 28 percent per annum.

The non-agricultural labour households have taken ₹31250 at zero rate of interest, ₹11875 at the rate of interest ranging between 1 to 7 percent, ₹37812.5 at the rate of interest above 29 percent, ₹7187.5 at the rate of interest ranging between 15 to 21 percent, ₹10625 at the rate of interest ranging between 8 to 14 percent and ₹9687.5 at the rate of interest ranging between 8 to 14 percent per annum.

The artisan households have taken ₹32727.27 at the rate of interest ranging between 1 to 7 percent, ₹20000 at the rate of interest ranging between 15 to 21 percent, ₹18636.36 at 8 to 14 percent range of rate of interest and ₹7272.73 at 21 to 28 percent range of rate of interest. The other households have taken ₹18181.82 at the rate of interest ranging between 8 to 14 percent and ₹4545.46 at the rate of interest ranging between 1 to 7 percent and ₹9090.91 at the rate of interest ranging between 15 to 21 percent per annum.

The relative shares of different ranges of rate of interest in the total debt are given in Table 7. The table demonstrates that 41.60 percent of the total debt of all categories has been taken at the rate of interest ranging between 15 to 21 percent. This proportion is the highest

Table 6. Debt according to rate of interest

(Mean values, in ₹)

Rate of interest (percent per annum)	Farm households	Agricultural labour households	Non-agricultural labour households	Artisan households	Other households	All sampled households
0	3282.44	2941.18	31250	0	0	4909.09
1-7	117419.86	19019.6	11875	32727.27	4545.46	75418.18
8-14	108771	9843.14	10625	18636.36	18181.82	70368.18
15-21	212389.3	32411.76	7187.5	20000	9090.91	135890.9
21-28	51145.04	784.31	9687.5	7272.73	0.00	32340.91
29 Above	0.00	20000	37812.5	0.00	0.00	7750
Total	493007.6	85000	108437.5	78636.36	31818.18	326677.27

Source: Field survey 2015-16.

Table 7. Debt according to rate of interest

(Percentage of total debt)

Rate of interest (percent per annum)	Farm households	Agricultural labour households	Non-agricultural labour households	Artisan households	Other households	All sampled households
0	0.67	3.46	28.82	0.00	0.00	1.50
1-7	23.81	22.37	10.95	41.62	14.28	23.09
8-14	22.06	11.58	9.80	23.79	57.13	21.54
15-21	43.08	38.13	6.63	25.43	28.57	41.60
21-28	10.37	0.92	8.93	9.26	0.00	9.90
29 Above	0.00	23.53	34.87	0.00	0.00	2.37
Total	100	100	100	100	100	100

Source: Computed from Table 6.

for the farm households followed by the agricultural labour, other, artisan and non-agricultural labour households.

Another considerable proportion (23.09 percent) of the total debt of an average sampled rural household comes in the range of 1 to 7 percent rate of interest. The artisan, non-agricultural labour, agricultural labour, farm and other households have taken 41.62, 10.95, 22.37, 23.81 and 14.28 percent, respectively at the rate of interest ranging between 1 to 7 percent per annum. An average sampled rural household has taken 21.54 percent of the total debt at 8 to 14 percent rate of interest. The other, artisan, farm, agricultural labour, and non-agricultural labour households have taken 57.13 percent, 23.79 percent, 22.06 percent, 11.58 percent and 9.80 percent, respectively at the rate of interest ranging between 8 to 14 percent per annum.

The foregoing analysis shows that the farm households, artisan, and other households have taken the maximum amount of debt at the lower rate of interest but on the other side, the agricultural labour and non-agricultural labour and have taken the maximum amount of debt at the high rates of interest. These households are depending upon non-institutional sources which charge the high rate of interest.

Determinants of Indebtedness

An attempt has also been made in this paper to identify economic factors influencing indebtedness among farmers, agricultural labourers,and all other households. The amount of debt at a point of time is influenced by several economic and non-economic factors. The various economic factors, important as they are in the policy framework, are subjected to analysis. It is hypothesized that indebtedness depends upon farm-size, family-size, ratio of credit from non-institutional sources to that from total debt, subsidiary income, expenditure on unproductive purposes and educational level of the head of households. This objective is met by fitting a number of series of regression function. Regression function finally selected is based upon the better Coefficient of Multiple Determination (R^2), significance of the parameters and sign of the regression coefficients which are theoretically consistent.

The estimated linear relationship between indebtedness and explanatory variables for the different categories of rural households is given in Table 8. The estimates indicates that the ratio of credit from non-institutional sources to that from institutional sources, income from subsidiary occupations, expenditure on unproductive purposes and educational level are the main determinants of indebtedness.

Farm Households: The estimated linear relationship between indebtedness and explanatory variables for the farmers is given in Table 8. The regression coefficient for the family size is non-significant statistically. The coefficients of the ratio of credit from non-institutional sources to that from total debt, expenditure on unproductive purposes and farm size are positive and statistically significant at one percent level of probability. This implies that the indebtedness increase with the

Table 8. Determinants of indebtedness: Results of multiple regression analysis

Factors	farm households	Agricultural labour households	Non-agricultural labour households	Artisan households	Other households	All sampled households
Family size	10677.59 (0.422)	3742.051 (0.499)	2078.421 (0.046)	11120.2 (0.964)	6204.204 (1.307)	3680.304 (0.173)
Ratio of credit from non-institutional sources to that from total debt	402.914*** (2.79)	-36.676* (-1.82)	6505.37 (1.47)	-	-	1211.294*** (7.546)
Income from subsidiary occupations	0.439* (1.832)	-0.608 (-.743)	-0.843 (-0.276)	0.443 (0.751)	0.498 (0.768)	0.533*** (2.134)
Expenditure on unproductive purposes	0.729* (9.659)	0.751*** (5.679)	0.620 (1.491)	1.471*** (3.849)	1.065*** (10.770)	0.833* (9.994)
Education level	-3781.56 (-0.562)	3230.23 (0.879)	11487.99 (1.214)	-3502.68 (-1.303)	1793.239 (0.739)	-130.55 (-0.022)
Farm size	17000.38*** (3.716)	-	-	-	-26760.962 (-0.829)	24860.031*** (5.420)
R^2	0.61	0.43	0.67	0.87	0.97	0.62

Source: Field Survey, 2015-16.
Figures in parentheses indicate t-values.
******and *Significant at one, and ten percent.***

increase in debt taken from institutional agencies, increase in farm size and increase in expenditure on unproductive purposes. The regression coefficient for the educational level is found to be negative which implies inverse relationship between educational level and indebtedness. This implies that with the increase in education level of the head of family reduce the magnitude of debt. This is due to awareness or more earnings from other sources. Together, all the explanatory variables explain 61 percent variations in the magnitude of indebtedness.

Agricultural labour Households: The regression coefficient for family size is of the order of 3742.05, indicating positive relationship of family size and indebtedness. This may be due to increased unproductive expenditure on family maintenance, marriages and so on with increase in family size. The regression coefficient for income from subsidiary occupations is found to be negative which implies inverse relationship between income and indebtedness. The coefficient of multiple determinations is 0.43. This suggests that explanatory variable explains 43 percent variation in the dependent variable.

Non-Agricultural labour Households: Variations in the magnitude of indebtedness among the non-agricultural labour households are explained by family size, income from subsidiary occupations and education level. The regression coefficient for the income from subsidiary occupations is found to be negative implies inverse relationship between income from subsidiary occupations and indebtedness. Together, all the explanatory variables explain 0.67 percent of the variation in the magnitude of indebtedness.

Artisan Households: The regression coefficient for the educational level is found to negative and statistically non-significant for artisan households. This implies that with the increase in educational level indebtedness decrease. The regression coefficient for the expenditure on unproductive purposes is positive and statistically significant for the artisan households. This implies that with the increase in unproductive expenditure indebtedness also increases. The coefficient of multiple determinations is 0.87 for artisan households.

Other Households: The regression coefficient for the farm size is found to negative shows inverse relationship between farm size and indebtedness in other households. The regression coefficient for the expenditure on unproductive purposes is positive and statistically significant for the other households. This implies that with the increase in unproductive expenditure indebtedness also increases. This type of expenditure is increased under social compulsions. The coefficient of multiple determinations is 0.97 for other households.

All Sampled Households: The regression coefficient for family size is positive but statistically non-significant. This implies that with the increase in family expenditure on family maintenance the indebtedness also increases. The regression coefficients for ratio of credit from institutional sources, income from subsidiary occupations and expenditure on unproductive purposes are positive and statistically significant. This implies that with the increase in ratio of non- institutional debt and expenditure on unproductive purposes like marriages burden of debt increases among rural households. The regression coefficient for education level is negative but statistically non-significant. This shows that increase in educational level of the head of the households of the family results in reducing the magnitude of indebtedness. The coefficient of multiple determinations is 0.62. This suggests that explanatory variable explains 62 percent variation independent variable.

CONCLUSIONS AND POLICY IMPLICATIONS

The above analysis shows that more than four-fifths of rural households in the Bathinda district are under debt. The average amount of debt per sampled household and per indebted households is ₹326677.24 and ₹392726.27, respectively in Bathinda District. The average amount of debt per household is the highest for the farm households and the lowest for the all other households. The farm and other households have taken debt mainly from the institutional agencies. The agricultural labour, non-agricultural and artisan households have taken debt mainly from the non-institutional agencies. Source wise, the agricultural labour, non-agricultural labour and artisan households have similarities in pattern. For these households, major sources of debt are the large farmers, traders and commission agents. For the farm households, the major sources of debt are commercial banks, co-operative banks and commission agents. These facts clearly brings out that even after seven decades of independence, the agriculture labour, non-agricultural labour and artisan households are still in the clutches of non-institutional agencies particularly large farmers and traders.

The farm households have taken loans mainly for the purchase of farm inputs. The agricultural labour, artisan, other and non-agricultural labour households have taken loans mainly for the family maintenance expenditure. The consumption expenditure exceeds income of the rural households, to maintain a minimum level of consumption and to bridge the income-consumption gap they have to borrow from different sources. The farm households and the other households have incurred the maximum amount of debt at lower rates of interest but, the agricultural labour, non-agricultural and artisan households have incurred the maximum amount of debt at high rate of interest. These households are still depending upon the non-institutional sources which charge exorbitant rates of interest.

There is an urgent need to take effective measure to overcome the problem of indebtedness. A system is required to be developed wherein there should be no cost of borrowing except interest. The government should provide interest-free loans to rural households. Proper

information should be provided to the poor sections about the institutional credit. There should be establishment of local public banks which provide loans at concessional rate. This will reduce the dependency of poor people on non-institutional sources and help them to attain loan at a low rate of interest.

The government must provide the free and compulsory education. The government should launch a program in order to provide free technical and vocational education to the children of rural households, so they may be able to establish their own ventures. Agro-based industries must be set up in rural area. It will provide employment opportunities at village level, which will have a positive impact on the income as well as the consumption levels of rural households. Effective measure should be taken to increase the income of the rural households by developing subsidiary occupations like dairy-farming, poultry farming, beekeeping, etc. The government must provide exotic breed of milch animals at subsidized rates. Minimum Support Prices of agricultural product must be fixed at reasonable level by taking into consideration cost of production and consumer price indices. Purchase of agricultural produce must be guaranteed by government agencies. To stabilize the prices of fruits and vegetables, the state should facilitate the establishment of processing industries and encourage the exports of agricultural products.

REFERENCES

Frankel, F.R. (1971). *India's Green Revolution economic gains and political costs* (p 90). Bombay Oxford University Press.

Government of India. (2016). *Economic survey of India*, Government of India, New Delhi

Government of Punjab. (2016), *Economic survey of Punjab.* Economics and Statistical Organization, Department of Planning, Chandigarh.

Government of Punjab. (2016a). *Statistical abstract of Punjab*. Economics and Statistical Organization, Chandigarh.

Ghuman, R.S. (2008). Socio-economic crisis in rural Punjab. *Economic and Political Weekly*, *43*(6), 12-15.

Gill, A., & Singh, L. (2006). Farmer's suicides and response of public policy: Evidence, diagnosis,and alternatives from Punjab. *Economic and Political Weekly*, *41*(22), 1538-1545.

Jeromi, P.D. (2007). Farmer's indebtedness and suicides: Impact of agricultural trade liberalization in Kerala. *Economic and Political Weekly*, *42*(31), 3241-3247.

Kaur, P., Singh, G., & Singh S. (2016). Magnitude and determinants of indebtedness among farmers in rural Punjab. *Indian Journal of Economics and Development*, *12*(1a), 241-251.

Kumar, R. (1993). *Debt position of farmers of district Ludhiana: A case study* (Master's Thesis). Punjab Agricultural University, Ludhiana.

NSSO. (2014). Employment and unemployment situation in India 2011-12, Ministry of Statistics and Programme Implementation Government of India.

Path, B.V. (2008). Agricultural indebtedness: Crisis and revival.*E conomic and Political Weekly*, *42*(5), 47-52.

Sidhu, H.S. (2002). Crisis in agrarian economy in Punjab: Some urgent steps. *Economic and Political Weekly*, *41*(38), 4009-4013.

Singh, G. (2014). Agrarian crisis in India and possible solution: An overview. *Indian Journal of Economics and Development*, *10*(1a), 74-81.

Singh, S., & Bhogal, S. (2014). Depeasantization in Punjab state of farmers who left farming. *Current Science, 106*(10), 1364-1368.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 324-329
DOI: 10.5958/2322-0430.2018.00117.8

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Structure of Credit and Indebtedness among Rural Farm Households in Punjab

Rajwant Kaur[1], and Sharanjit Singh Dhillon[2]*

Research Scholar and [2]Professor Punjab School of Economics, Guru Nanak Dev University, Amritsar-143005

[*]Corresponding author's email: rajwantdhillon26@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-91* *Revision Accepted: March 03, 2018*

ABSTRACT

Credit is an important input which has played significant role in development of Punjab agriculture. Introduction of green revolution made farmers proficient to go for intensive cultivation through multiple cropping patterns and their demand for purchasing inputs has increased, which made them dependent upon institutional and non-institutional sources of finance. In light of this, the present study made an effort to examine structure of credit and indebtedness among farmers in Tarn-Taran district of Punjab. The study is based on the primary survey and the data has been collected from 100 respondent farmers through questionnaire and simple statistical tools have been used to analyze the data. The results shows a positive relationship has been found between size of holdings and loans taken from institutional sources. Moreover, the study found that large number of farmers were under debt and majority of marginal and small farmers availed loan for unproductive purposes, whereas, medium and large farmers took loan for productive purposes. The main cause of indebtedness or high rate of outstanding loans was the high rate of interest being charged from farmers and their low level of income. As the size of holding increases, the proportion of outstanding loans of net income decreases. It was found that an outstanding loan per household, as well as repayment per household, was highest in the case of large farmers. However, debt per acre was highest in the case of marginal and small farmers.

Keywords
Agriculture, credit, debt.

JEL Codes
E43, E51, G21, Q12, Q14.

INTRODUCTION

Agriculture plays a crucial role in the national economy as well as in the economy of Punjab. Around 65 percent of Indian population depends on agriculture for their livelihood (Singh, 2000). Punjab in particular, witnessed phenomenal development in agriculture sector especially post green revolution era. The state has observed large increase in the agricultural production during 1960's and onwards, mainly due to complementary and supportive role played by institutional and technological factors.

As far as rural finance is concerned, agriculture finance/credit turn out to be its major subset. Agriculture credit is required at each and every stage of cultivation like input supply, production, and distribution. With the advent of modern agriculture, use of inputs such as seeds, fertilizers, irrigation, machinery, etc. has increased demand for agricultural credit (Kaur, 2013). With the transformation of production pattern from subsistence to commercial crops, the need for credit also increases (Shergill, 1997, 2010; Singh *et al*.. 2012). Also, the onset of Green Revolution enabled the farmers to adopt intensive cultivation approach and as a result, their demand for purchased inputs has increased which made them dependent on institutional and non- institutional sources of finance (Kaur, 2013).

While the claims are made that institutional credit has checked the exploitation by the moneylenders, the reality was that the share of institutional rural credit fell from a peak of 15.3 percent in 1987 to 8.4 percent in 2006 availed by farmers in Punjab. Rest of the demand for credit is fulfilled by non-institutional sources. The main non-institutional source of credit is the commission agents or arthiyas. An average farmer in Punjab was getting 54

percent of the total non-institutional credit from the commission agents (Singh, 2015). Such agents were supplying credit at a higher rate of interest, negatively affecting farming community, in general, and small and marginal farmers, in particular. The present scenario gives birth to a harsh contradiction- on the one hand, lack of sufficient supply of institutional credit compel the farmers to borrow from non-institutional sources, while on the other, these turn out to be the main source of exploitation of the farmers. As par recent decennial report of National Sample Survey Organization (2013) in Punjab, every farmer had a debt of ₹5.39 lakh, and 13.3 percent of these farmers were borrowing money at an interest rate of 30 percent or more. Commission agents (Arthiyas) are emerging as the prominent moneylenders in the 21st Century, even in villages that have banks. Incidence of indebtedness of cultivator households was 40.19 percent in Punjab. The state has also registered a higher increase in the average amount of debt outstanding per household.

According to ICSSR survey (Dhaliwal, 2016) stated that in Punjab farmers total debt has gone up to ₹69,355 crore. Of it, ₹56,481 crore was borrowed from institutions. Apparently, institutional loans have gone up with little or no change in the amount of non-institutional loans. Marginal, small farmers and landless laborers, who have not got adequate assets to mortgage, are more dependent on non-institutional sources for securing a loan.

Keeping in mind the above state of affairs in the rural economy of Punjab, the objectives of the study were:

i. to analyze the structure of credit of the farmers, and
ii. to analyze indebtedness of farm household's in villages.

METHODOLOGY

The aim of the present study is to compute the structure of credit and indebtedness among farmer households in Punjab was undertaken to analyze the social and economic conditions of this group of farming community. Study pertains to District Tarn Taran and made use of primary data, collected in the agricultural year 2013-14. Data were collected directly from the selected farmers and for this purpose, specially prepared schedule was used.

Keeping in view, various considerations and trying to strike a balance between the requirements of sampling theory and time, a three-stage stratified random sampling technique was used in this survey to select the farmers. Block selection was the first stage of sampling unit, villages the second unit and farmers was the third stage of sampling unit.

Selection of households: From each of these selected villages, 25 farmers were selected, taking each from the five size groups viz., Marginal (0-2.5) acres, Small (2.5-5) acres, Semi- Medium (5-10) acres, Medium (10-25) acres, and Large farmers (above 25) acres. Thus, in all 100 farmers were selected from four villages, with 25 farmers belonging to each category of farmers.

Field level data from the sample households were collected by personal interview with the help of prepared schedule. The data pertained to the details source of credit, loans, and debt position were collected from the farmers of selected villages. A simple technique of average and percentage were made along with tabular analysis were applied to analyze the data for achieving desired objectives.

RESULTSAND DISCUSSION

There are different agencies that provide credit to the farmers for different tenures and for different purposes for which credit is demanded. These agencies can be divided into institutional and non- institutional sources. With the change in technology and methods of cultivation, the need for credit has increased. An attempt has been made to analyze the structure of credit taken by agricultural households for various purposes and sources thereof and indebtedness of surveyed farmers. For this purpose, paper has been divided into three sections. In Section-I, credit structure, credit pattern from institutional and non-institutional sources has been examined. Credit repayments and outstanding have been discussed in Section-II. Conclusion represents in Section-III.

Credit Structure

In credit structure, the percent of households taking loan from institutional and non-institutional sources has been analyzed.

The distribution of farmers according to their debt position has been presented in Table 1. It reveals that 26.67 percent of marginal farmers got loans from institutional sources and the rest 73.33 percent from institutional sources. However, 66.67 percent of large farmers have taken loan from non-institutional sources and 33.33 percent from non-institutional sources. Thus, it is clear from the table that as the farm size increases (rise) the amount borrowed from institutional agencies also increases and the dependence on non-institutional sources have decline.

The total loans to farmers of different categories from institutional and non-institutional have been worked out and the same is presented in Table 2. Analysis shows that farmers got more loans from institutional sources (66.52 percent) than non-institutional sources (33.48 percent). Per farmer loan works out to be ₹41282.94 of this institutional loan was to tune of ₹27461.24 and non-institutional loan was ₹13821.70. Thus, this shows that with the increase in the size of holdings loan from institutional sources increases and non-institutional sources decreases.

Credit of farmers from institutional sources has been presented in Table 3. Table shows that regional rural banks provide 59.38 percent of total institutional farm credit to sample farmers; commercial banks contributed 37.35 percent and share of co-operative society was3.27 percent. Co-operative societies provided credit to

member farmers as per their limit in the co-operative society. Analysis shows that average credit for sample works out to be ₹68125. It shows a positive relationship between size of land holdings and loans from institutional sources.

The results revealed that with the increase in size of holding loans taken from institutional sources, that is, Regional Rural Banks also increases. This is because large farmers knows better the legal formalities involved in getting loans from institutional sources and perhaps also because they have collateral or security in the form of land.

Analysis also stated a credit pattern of farmers from non-institutional sources in another Table 4. On an average marginal, small, semi-medium, medium and large farmers have taken loans of ₹22727.27, ₹21928.51, ₹20470.59, ₹28666.67, and ₹25187.50 respectively from non-institutional source. Average credit from non-institutional sources for the whole sample works out to be ₹229610.4.The perusal of Table 4 also shows that average loan taken from commission agents was ₹12401.30, from landlords, was ₹7290.91, and from village, shopkeeper was ₹816.88. Thus, study shows that in the case of non-institutional sources, more credit was taken from commission agents.

Table 1. Distribution of farmers according to their debt position

Size of holding	Institutional sources		Non-institutional sources		Total
	Number of farmers	Percent share of farmers	Number of farmers	Percent share of farmers	
0-2.5 (Marginal)	8	26.67	22	73.33	30
2.5-5 (Small)	8	27.59	21	72.41	29
5-10 (Semi- medium)	8	32.00	17	68.00	25
10-25 (Medium)	12	57.14	9	42.86	21
25 and above (Large)	16	66.67	8	33.33	24
Total	52	40.31	77	59.69	129*

Source: Field Survey.
**Number of respondents exceeds 100 as number taken loans from more than one source.*

Table 2. Distribution of farmers according amount of credit from institutional and non-institutional sources

(₹)

Landholding (acres)	Number of farmers	Institutional sources	Non-institutional sources	Total credit	Per acre credit
0-2.5 (Marginal)	30	65,000 (11.61) [21.66.67]	4,95,000 (88.39) [16500]	5,60,000 (100.00) [18666.67]	13023.25
2.5-5 (Small)	29	95,000 (16.51) [3275.86]	4,80,500 (83.49) [16568.96]	5,75,500 (100.00) [19844.82]	4756.20
5-10 (Semi-Medium)	25	4,73,000 (57.61) [18920]	3,48,000 (42.39) [13920]	8,21,000 (100.00) [32840]	3818.60
10-25 (Medium)	21	9,96,500 (79.43) [47452.38]	2,58,000 (20.57) [12285.71]	12,54,500 (100.00) [59738.09]	2727.17
25 & above (Large)	24	19,13,000 (90.47) [79708.33]	2,01,500 (9.53) [8395.83]	21,14,500 (100.00) [88104.16]	2800.66
Total	129*	35,42,500 (60.52) [27461.24]	17,83,000 (33.48) [13821.70]	53,25,500 (100.00) [41282.94]	3338.87

Source: Field Survey.
( ) shows percentages of totals, [ ] shows the averages,
**Number of respondents exceeds 100 as number taken loans from more than one source.*

Table 3. Credit from institutional sources

(Number; ₹)

Landholding (acres)	Co-operative society	Regional rural banks	Commercial banks	Total credit	Number of farmers	Average
0-2.5 (Marginal)	(2) [20] 13000	(5) [64.62] 42000	(1) [15.38] 10,000	(8) [100] 65000	8	8125
2.5-5 (Small)	(1) [9.47] 9000	(6) [82.11] 78000	(1) [8.42] 8000	(8) [100] 95000	8	11875
5-10 (Semi-Medium)	-	(6) [56.66] 2,68000	(2) [43.34] 2,05,000	(8) [100] 473000	8	59125
10-25 (Medium)	(3) [6.22] 62000	(7) [73.71] 7,34,500	(2) [20.07] 2,00,000	(12) [100] 9,96,500	12	83041.7
25 and above (Large)	(3) [1.67] 32000	(9) [51.28] 9,81,000	(4) [47.05] 9,00,000	(16) [100] 19,13,000	16	119562.5
Total	(9) [3.27] 1,16,000	(33) [59.38] 21,03,500	(10) [37.35] 13,23,000	(52) [100] 35,42,500	52	-
Average	2230.8	40451.9	25442.3	68125	-	-

Source: Field Survey.
( ) brackets show the numbers;
[ ] a bracket shows a percentage of totals.

Table 4. Credit from non-institutional sources

(Number; ₹)

Landholding (acres)	Commission agents	Landlords	Friends & relatives	Village shop-keeper	Total credit	Number of farmers	Average
0-2.5 (Marginal)	(12) 250000 [50.50]	(4) 145000 [29.29]	(3) 68500 [13.85]	(3) 31500 [6.36]	(22) 495000 [100.00]	22	22727.27
2.5-5 (Small)	(11) 230000 [47.87]	(5) 175500 [36.52]	(3) 43600 [9.08]	(2) 31400 [6.53]	(21) 480500 [100.00]	21	21928.57
5-10 (Semi- Medium)	(10) 185100 [53.19]	(5) 120500 [34.63]	(2) 42400 [12.18]	-	(17) 348000 [100.00]	17	20470.59
10-25 (Medium)	(5) 156300 [60.58]	(3) 76000 [29.46]	(1) 25700 [9.96]	-	(9) 258000 [100.00]	9	28666.67
25 & above (Large)	(5) 133500 [66.25]	(2) 44400 [22.03]	(1) 23600 [11.72]	-	(8) 201500 [100.00]	8	25187.5
Total	(43) 954900 [53.55]	(19) 561400 [31.49]	(10) 203800 [11.43]	(5) 62900 [3.53]	(77) 1783000 [100.00]	77	22961.04
Average	12401.30	7290.91	2646.75	816.88	23155.84	-	-

Source: Field Survey.
( ) shows percentages of totals; [ ] shows the averages.

Table 5. Distribution of farmers according to outstanding and repayment

(₹)

Land of Holding (acres)	Total area (acre)	Number of farmers	Outstanding	Outstanding per households	Outstanding per acre	Repayment	Repayment per household	Repayment per acre	Total debt	Debt per household	Debt per acre
0-2.5 (Marginal)	43	22	415000 (13.04) [74.11]	18863.64	9651.16	145000 (6.77) [25.89]	6590.91	3372.09	560000 (10.51) [100.00]	25454.54	13023.25
2.5-5 (Small)	121	21	370000 (11.62) [64.29]	17619.05	3057.85	205500 (9.59) [35.71]	9785.71	1698.35	575500 (10.81) [100.00]	2704.76	4756.20
5-10 (Semi-Medium)	215	19	486000 (15.27) [59.20]	25578.95	2260.46	335000 (15.64) [40.80]	17631.58	1558.14	821000 (15.42) [100.00]	43210.53	3818.60
10-25 (Medium)	460	12	688300 (21.62) [54.89]	57358.33	1496.30	565700 (26.41) [45.11]	47141.67	1229.78	1254000 (23.55) [100.00]	104500	2727.17
25& Above (Large)	755	16	1223900 (38.45) [57.88]	76493.75	1621.06	890600 (41.59) [42.12]	55662.5	1179.60	2114500 (39.71) [100.00]	132156.25	2800.66
Total	1595	90	3183200 (100.00) [59.77]	35368.89	1995.74	2141800 (100.00) [40.23]	23797.77	1342.82	5325500 (100.00) [100.00]	59172.22	3338.87

Source: Field Survey
( ) shows the percentages of the total.
[ ] shows the averages.

Section-II

Indebtedness among Rural Farm Households

Credit repayment and outstanding are also important ingredients of credit structure of the sample farmers in the study area. Short term loans are advanced by commission agents which are almost fully repaid sooner or later due to forced sale of their produce through commission agents, new form of moneylenders from whom they have taken loan. The commission agents deduct the whole or part amount of interest. The principal amount of loan while making payments of sale proceeds to the farmers.

Analysis shows credit repayment and outstanding loans in Table 5. It shows maximum repayments (41.59 percent) were made by large farmers. It reveals that outstanding per household was maximum (₹76493.75) in the case of large farmers and outstanding per acre was maximum (₹9651.6) in the case of marginal farmers. Similarly, repayments per household was maximum (₹55662.5) in the case of large farmers. Analysis of credit and debt position of farmers reveals that there are few households in a position to save. Majority of farmers who were under debt were of the view that complicated procedure of banks and co-operative societies to advance loans discourages them from approaching these agencies for loans.

CONCLUSIONS

Analysis of credit and debt position of farmers reveals that there are few households in a position to save. Furthermore, it is found that maximum number of farmers is under debt. Commercial banks, co-operative society, regional rural banks, commission agents, and landlords were the main sources from where these farmers took loan. Study reveals that farmers took loan for unproductive purposes from commission agents and landlords. Commercial banks, regional rural banks, and co-operative society approached for productive purposes. Majority of farmers who were under debt were of the view that complicated procedure of banks and co-operative societies to advance loans discourages them from approaching these agencies for loans.

POLICY SUGGESTION

Certain policy suggestions flows from study are as follows:

(i) As the use of institutional credit is less in use of small farmers, then flow of credit from financial institutions should be re examined and more credit should be made available at lower rate of interest so that the dependency of agriculturists particularly small landholders on non-institutional sources is reduced. Further, legal formalities and paperwork should be made simpler so that illiterate borrowers could get benefit from institutional sources.

(ii) Study found a positive relationship between education, land of farmers and institutional credit so efforts should be made to improve the educational system in rural areas. Efforts should be made to ensure that all children in rural areas at least get education till +2 level which is easily available at the village level itself.

(iii) They should also be encouraged to take up some sectorial causes to enhance their earning abilities outside agriculture. This will reduce the indebtedness of small farmers to some extent.

REFERENCES

Dhaliwal, S. (2016). Farmers debt rises to ₹69355 crore: Survey. *The Tribune,* Chandigarh.

Kaur, P. (2013). *Punjab economy: Performance and prospects*. New Delhi: Published by Regal publications.

National Sample Survey Organisation. (2013). *Key indicators of debt and investment in India*, 2012-13. New Delhi: National Sample Survey Organisation.

Shergill, H.S. (1997). *Rural credit and indebtedness in Punjab*. Chandigarh: Institute for Development and Communication (IDC).

Shergill, H.S. (2010). *Growth of farm debt in Punjab: 1997 to 2008.*Chandigarh: Institute for Development and Communication.

Singh, B. (2000). *Agricultural credit: Sources, problems and emerging issues*. New Delhi: Deep & Deep Publication.

Singh, J., Grover, D.K., & Dhaliwal, T.K. (2012). *State agricultural profile*: *Punjab*. Agro Economic Research Centre, Punjab Agricultural University, Ludhiana.

Singh, R. (2015, October 23). When debt outlives the debtor. *The Tribune*, Chandigarh.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 330-335
DOI: 10.5958/2322-0430.2018.00078.1

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Farm Investment and Income Variations across different Farm size Categories and Regions in Punjab

Manjeet Kaur, Sukhpal Singh, V.K. Sharma, H.S. Kingra and Rakhi Arora*

**Department of Economics and Sociology, Punjab Agricultural University, Ludhiana*

**Corresponding author's email- manjeet.randhawa@yahoo.com*

Received: January 15, 2018 *Manuscript Number: NS-18-97* *Revision Accepted: March 10, 2018*

ABSTRACT

The study analyzed the farm investment pattern and level of income over different size categories of farms and various Zones of the Punjab state. The study is based on the data collected for the agricultural year 2014-15 under the scheme 'Economics of Farming and Financial position of Punjab farmers' from 325 farm holdings, 50 holdings were selected from Zone I, 175 from Zone II and 100 from Zone III. The category wise sample consisted of 49 marginal, 75 small, 88 semi-medium, 55 medium and 58 large farming households. An effort was made to find out the reasons for different investment behavior in different Zones. The study revealed that on average ₹486457 per farm were invested in different components of capital assets. The highest amount of investment (32.66 percent) was made on machinery followed by 29.39 percent on livestock, 19.65 percent on farm buildings and 18.35 percent on irrigation. The investment on all the capital assets per farm increased with the size of farm except on livestock. The pattern of investment across different farm sizes showed a positive relationship with the farm size on per farm basis yet it did not hold true in case of per ha. Out of all the components of capital assets viz. farm building, irrigation, machinery, and livestock; the major amount of investment was done on machinery in all the Zones of the state. Zone-III emerged as the highly capitalized Zonewith the total investment of ₹587109 per farm on different capital assets followed by Zone-II with ₹518535 per farm and Zone-I with the investment of ₹92072 per farm.The estimates and the magnitude of per farm and per ha gross farm income and net farm income on different farm size categories revealed that a large farmer earned five times more annual net income per farm as compared to marginal farmers.

Keywords
Capital assets, gross farm income, net farm income, pattern of investment.

JEL Codes
Q10, Q160.

INTRODUCTION

The performance of agriculture sector has always been the most important vehicle for sustainable livelihood of the people of Punjab and the north-west region in general. Being the largest contributor of main cereals to the central pool, Punjab has earned the title of Granary of India or Food Basket of India. The introduction of new seed-fertilizer technology in mid-1960's marked the beginning of a new chapter in the history of Punjab agriculture. The development of high yielding varieties of wheat and rice necessitated the greater capital requirements on farms in Punjab. The variable capital requirement increased in the form of higher use of inputs and consequently the demand for fixed capital particularly investments in irrigation, machinery, infrastructure also increased. As the productivity and production increased responded to dynamics of these changes and farmers' income improved, private investments in irrigation structures, livestock, and farm mechanization assumed greater significance in agricultural development scenario of the state (Singh & Sidhu, 2005). Presently, the state has very high density of tractors (4.88 lakh), irrigation structures (14.04 lakh tube wells,) and farm machinery (3.70 lakh threshers and 12068 combine harvesters). Since the technology followed by the farming community is capital intensive,

hence it has its impact on the pattern of investment and income. The paper tries to examine the pattern of investment on different components of capital assets on different farm size categories and the regional variations in it. The paper also studies the level of income across different farm size categories and regions.

METHODOLOGY

The Primary data collected under the scheme 'Economics of Farming and Financial position of Punjab farmers' were used for the study. In order to capture the regional variations, Punjab was divided into three agro-climatic Zones based on the cropping pattern, soil type, physiography and water availability, etc. The respective regions were classified as sub-mountainous Zone (Zone-I), central Zone (Zone-II) and southwestern Zone (Zone-III). The sampling design of the study was three-stage stratified random sampling with development block as first stage sampling unit, village as the second stage unit and operational holding as third stage sampling unit. The sampling design consisted of 13 blocks comprising of 2 from Zone-I, 7 from Zone-II and 4 from Zone-III. Twenty farm holdings from each of the selected villages were chosen at random in proportion to the total number of holdings falling in each size group of farms. Thus, in all 325 holdings were selected for the study. Out of 325 holdings, 50 holdings were selected from Zone I, 175 from Zone-II and 100 from Zone-III. The category wise sample consisted of 49 marginal (<1 ha), 75 small (1-2 ha), 88 semi-medium (2-4 ha), 55 medium (4-6 ha) and 58 large (>6 ha) farming households. The data pertains to the agricultural year 2014-15. The simple averages were used to examine the magnitude of different variables on different basis such as, per farm and per ha.

RESULTS AND DISCUSSION

It is a proven fact that in a large economy, different regions with varying resource bases and endowments support dissimilar growth paths over time (Williamson, 1965). Punjab, not being an exception, the issue of regional disparities as observed in the level of investment and income across different Zones.

Farm Size Category Wise Socio-economic Profile

The socio-economic characteristics have a direct bearing on how people channelize the available resources and finances for their growth and development. The overview of socio-economic characteristics of respondent farmers as discussed in Table 1 highlights that 69.41 percent respondents were in the age group of 15-59 years. Nearly 31 percent respondents studied upto middle; 27 percent were matriculated and 24 percent attended college to do graduation and post-graduation. The average number of family members was 4.80 in

Table 1. Farm size category-wise socio-economic profile of respondent farmers in Punjab, 2014-15

(Percentage)

Particulars	Marginal	Small	Semi-medium	Medium	Large	Overall
Age (Years)						
Upto 14	15.74	15.53	17.22	15.70	13.76	15.69
15 to 59	69.36	70.87	68.49	68.60	69.84	69.41
Above 59	14.89	13.59	14.29	15.70	16.40	14.89
Education						
Illiterate	16.60	23.06	15.46	19.72	17.72	17.87
Primary	14.04	11.89	13.50	18.66	11.11	13.09
Middle	17.87	18.69	18.59	20.07	16.14	17.66
Matric	28.94	26.46	27.01	30.28	28.57	27.07
Graduation and above	22.55	19.90	25.44	11.27	26.46	24.31
Average number of family members	4.80	5.49	5.81	6.25	6.52	5.78
Average size of operational holding (ha)	0.76	1.55	2.99	5.06	10.4	4.00
Area under major crops (percent of net area sown)						
Wheat	85.53	85.81	88.63	89.33	88.96	88.50
Paddy	47.37	62.58	70.23	76.48	83.59	76.25
Maize	23.68	17.42	16.05	13.24	9.79	13.27
Cotton	10.53	7.74	5.02	4.74	3.65	4.75
Other crops	36.84	31.61	24.41	21.34	19.19	22.25
Family income						
Crops	35.20	56.30	73.26	81.77	86.09	74.52
Dairy	31.85	28.88	20.24	14.60	10.29	16.31
Miscellaneous income	32.95	14.82	6.50	3.63	3.62	9.17
Total	100.00	100.00	100.00	100.00	100.00	100.00

marginal households, 5.49 in case of small farmers; 5.81 in semi-medium; 6.25 in medium and 6.52 in large farming households. Correspondingly, the average size of operational holding was 0.76, 1.55, 2.99, and 5.06 ha and 10.4 has in case of marginal, small, semi-medium, medium and large farmers. Wheat and paddy were the major crops grown by all the categories of farmers. The analysis further reveals that income from crops was the major source of income for large farmers (86.09 percent) in comparison to marginal and small farmers who were dependent on dairy enterprise and other miscellaneous sources to supplement their farm income.

Region-wise Socio-economic Profile

The regional level analysis of the socio-economic profile as stated in Table 2 reveals that the majority of the farmers (69.52 percent) were between the age group of 15 to 59 years; out of which 25 percent have studied upto matric and 29 percent have completed graduation. The Zone-I had a higher proportion of people in age group of 15-59 years and had better literacy status. The average number of members was found to be 5.78 in the state.

The overall size of operational holdings was 4 ha. The average size of operational holdings was higher in Zone-II as compared to other Zones of the state. The pattern of crops given in the state revealed that wheat and paddy in Zone-II followed by maize in Zone-I and cotton in Zone-III were the main crops grown. The major proportion of income of all the categories of farm families was agriculture, contributing to 74.52 percent share in total income followed by 16.31 percent by dairy enterprise and 9.17 percent from other miscellaneous sources. The income from crops was the highest in Zone-III (83.60 percent) followed by Zone-II (74.18 percent) and Zone-I (49.18 percent) while the share of dairying enterprise was highest in Zone-I (30.12 percent) of the state. Hence, it can be said that the majority of respondents were in their prime earning age and were fairly educated and dependent on agriculture for their livelihood.

Farm Size Category-wise Investment Pattern

The character of agrarian economy of Punjab is fundamentally capital intensive since the onset of green revolution. The study of pattern of investment across different farm size categories performed per farm and per ha basis in the state (Table 3) revealed that on an average ₹486457 per farm were invested over different components of capital assets. The highest amount of investment (32.66 percent) was made on machinery followed by 29.39 percent on livestock, 19.65 percent on farm buildings and 18.35 percent on irrigation. Overall it was observed during the study that investment on all the capital assets per farm increased with the size of farm except on livestock. The investment on dairy enterprise

Table 2. Zone-wise socio-economic profile of respondent farmers in Punjab, 2014-15

(Percentage)

Particulars	Zone-I	Zone-II	Zone-III	Overall
Age (Years)				
Upto 14	18.55	14.70	16.03	15.69
15 to 59	74.91	68.70	68.43	69.52
Above 59	6.54	6.60	15.54	14.79
Education				
Illiterate	7.64	13.00	20.66	14.79
Primary	12.73	13.80	14.05	13.72
Middle	17.45	17.10	17.85	17.39
Matric	41.09	23.00	20.83	24.95
Graduation and above	20.36	33.10	26.61	29.15
Average number of family members	5.50	5.71	6.05	5.78
Average size of operational holding (ha)	2.47	4.38	4.10	4.00
Area under major crops (percent of net area sown)				
Wheat	92.31	86.07	91.95	88.50
Paddy	-	88.13	77.07	76.25
Maize	92.31	2.51	-	10.25
Cotton	-	-	14.88	4.75
Other crops	16.20	26.71	89.56	22.25
Family income				
Crops	49.18	74.18	83.60	74.52
Dairy	30.12	19.37	11.69	16.31
Miscellaneous income	20.70	6.45	4.71	9.17
Total	100.00	100.00	100.00	100.00

was more on marginal farms as compared to large farming households.

In order to remove the size effect and to make the analysis comparable, the per farm total investment figures have been divided with the size of the farm and the information, thus computed, has been presented in Table 4. The results show that the total farm assets value i.e. investment on per ha basis has been worked out to about ₹1.31 lakhs on an average farm in the state. Out of which investment in machinery accounted for ₹42822 per ha; livestock for ₹38599 per ha; farm buildings for ₹25756 per ha and irrigation structures for ₹24071 per ha respectively. Amongst the different size-categories the marginal farmers majorly invested in livestock (₹91917); small farmers spend heavily on farm buildings and irrigation structures to the extent of ₹35135 per ha and ₹34641 per ha, respectively. The major component of investment, that is, machinery was highest amongst semi-medium farmers to the tune of ₹39891 per ha.

The pattern of investment across different farm sizes showed a positive relationship with the farm size on per farm basis yet it did not hold true in case of per ha as also observed by Saini (2017); Khatkar *et al.* (2013). The magnitude of investment on the components of capital assets namely; farm building, irrigation, machinery, and livestock were by and large positively related to the farm size. The small farmers relatively invested more in livestock and building whereas the large farms invested more in farm machinery. However, per ha amount of investment bore an inverse relationship with the farm size.

Region-wise Investment Pattern

The examination of the Zone-wise investment on capital assets in Punjab had been carried out and the information obtained in this respect had been given in Table 5. It is clear from the table that Zone-III was highly

Table 3. Farm size category-wise pattern of investment over different components of capital assets in Punjab, 2014-15

(₹/farm)

Size group	Farm building	Irrigation	Machinery	Livestock	Total capital assets
Marginal	27438 (22.10)	19915 (16.04)	2917 (2.35)	73893 (59.51)	124163 (100.00)
Small	56632 (23.16)	56165 (22.97)	28724 (11.75)	103029 (42.13)	244550 (100.00)
Semi-medium	65463 (16.57)	75509 (19.11)	114077 (28.87)	140038 (35.44)	395087 (100.00)
Medium	164009 (21.00)	112898 (14.45)	350982 (44.94)	153188 (19.61)	781077 (100.00)
Large	155204 (19.53)	159372 (20.06)	265672 (33.44)	214311 (26.97)	794559 (100.00)
Overall	95382 (19.61)	89271 (18.35)	158853 (32.66)	142951 (29.39)	486457 (100.00)

Figures in parentheses are the percent of the total.

Table 4. Farm size category-wise pattern of investment over different components of capital assets in Punjab, 2014-15

(₹/ha)

Size group	Farm building	Irrigation	Machinery	Livestock	Total capital assets
Marginal	34130 (22.15)	24410 (15.84)	36277 (23.54)	91917 (59.65)	154084 (100.00)
Small	35135 (23.19)	34641 (22.86)	17821 (11.76)	63919 (42.19)	151516 (100.00)
Semi-medium	22891 (16.57)	26405 (19.11)	39891 (28.87)	48969 (35.44)	138156 (100.00)
Medium	34033 (21.04)	23427 (14.49)	72470 (44.81)	31788 (19.66)	161718 (100.00)
Large	20699 (19.54)	21256 (20.07)	35433 (33.45)	28530 (26.94)	105918 (100.00)
Overall	25756 (19.62)	24071 (18.34)	42822 (32.63)	38599 (29.41)	131248 (100.00)

Figures in parentheses are the percent of the total.

capitalized Zone with total investment of ₹587109 per farm on different capital assets followed by Zone-II with ₹18535 per farm and Zone-I with the investment of ₹92072 per farm. Out of all the components of capital assets viz. farm building, irrigation, machinery, and livestock; the major amount of investment was done on machinery in all the Zones of the state.

The per ha analysis of investment pattern (Table 6) highlighted that assets value was the highest in south-western Zone (Zone-III) ₹143476 followed by Zone-II with ₹140653 and with ₹36141 in Zone-I.

The comparison on regional level depicted that the investment per farm on all the components of capital assets were highest in Zone-III. The investment in machinery and livestock per ha was observed to be highest in Zone-II of the state.

Farm Size Category-wise Farm Income

The following discussion encapsulates information regarding category wise and Zone-wise gross farm income and net farm income. Gross farm income includes income from crops and dairying worked out for the sampled households and net farm income was computed by deducting the costs incurred on seed, fertilizer, insecticides/pesticides, hired human labour/bullock labour, farm machinery and implements, taxes, cess, water charge, interest on working capital and cost of purchased feed and fodder along with depreciation of owned farm machinery and farm buildings from gross farm income.

The results presented Table 7 exhibit the estimates and the magnitude of per farm and per hagross farm income and net farm income on different farm size categories. The analysis revealed that on an average a farmer in state earns ₹5.95 lakhs gross income per farm annually and after deducting all the expenses he is left with net ₹3.58 lakhs per farm. The gross income ranged from ₹1.62 per farm on marginal farms to ₹12.27 lakhs per farm on large farming households. While a large farmer earned (₹6.53 lakhs) five times more annual net income per farm as compared to marginal (₹1.19 lakhs) farmers.

In order to ignore the farm size impact, per farm gross farm income was converted to per ha basis. It is apparent that an average farm family recorded ₹1.48 lakhs per ha as gross farm income and ₹89689 net income in the state during the year 2014-2015. So far as size-wise analysis is concerned, almost inverse relationship was recorded between the gross farm income and net farm income per ha and the size of farm.

Region-wise Farm Income

The income analysis in different agro-climatic Zones is presented in Table 8. The information in the table

Table 5. Zone-wise pattern of investment over different components of capital assets in Punjab, 2014-15

(₹/farm)

Zones	Farm Building	Irrigation	Machinery	Livestock	Total capital assets
I	15792	22544	39004	14732	92072
	(17.15)	(24.49)	(42.36)	(16.00)	(100.00)
II	59320	80245	221776	157194	518535
	(11.44)	(15.48)	(42.77)	(30.32)	(100.00)
III	157974	121809	135879	171447	587109
	(26.91)	(20.75)	(23.14)	(29.20)	(100.00)
Overall	95382	8927	158853	142951	486457
	(19.61)	(18.35)	(32.66)	(29.39)	(100.00)

Figures in parentheses are the percent of the total.

Table 6. Zone-wise pattern of investment over different components of capital assets in different Zones of Punjab, 2014-15

(₹/ha)

Zone	Farm Building	Irrigation	Machinery	Livestock	Total capital assets
I	5911	10120	14597	5513	36141
	(16.36)	(28.00)	(40.39)	(15.25)	(100.00)
II	16214	21934	59538	42967	140653
	(11.53)	(15.59)	(42.33)	(30.55)	(100.00)
III	38606	29767	33206	41897	143476
	(26.91)	(20.75)	(23.14)	(29.20)	(100.00)
Overall	25756	24071	42822	38599	131248
	(19.62)	(18.34)	(32.63)	(29.41)	(100.00)

Figures in parentheses are the percent of the total.

Table 7. Farm size category-wisefarm income (crops and dairying) in Punjab, 2014-15

Category	₹Farm		₹/ha	
	Gross farm income	Net farm income	Gross farm income	Net farm income
Marginal	162779	119229	253657	156880
Small	295488	201930	190637	130277
Semi-medium	472980	311802	158187	104282
Medium	803119	507875	158719	100370
Large	1227308	653615	122007	62727
Overall	595801	358756	148950	89689

Table 8. Zone-wise farm income (crops and dairying) in Punjab, 2014-15

Zone	₹/Farm		₹/ha	
	Gross farm income	Net farm income	Gross farm income	Net farm income
I	137846	78669	56360	31716
II	65981	400871	150660	91523
II	717152	419759	174915	102380
Overall	595801	358756	148950	89689

revealed the highest gross as well as net farm income in south-western Zone (Zone-III). The gross income per farm was ₹7.17 lakhs and net income were ₹4.19 lakhs in this Zone in comparison to the state average of `5.95 lakhs gross income per farm and ₹4.19 lakhs net income per farm. The same trend was observed on per ha basis also. The gross income at the state level was ₹1.48 lakh per ha and net income came out to be `89689**per ha**. It was again higher in Zone-III followed by Zone-II and I.

CONCLUSIONS

The level of both investment and income was highest in south-western Zone (Zone-III) followed by central Zone (Zone-II) and sub-mountainous Zone (Zone-I).The Zone-wise picture of investment revealed that the investment on per farm basis was the highest in Zone III (Wheat-Cotton) with ₹587109 followed by Zone II (Wheat-Paddy) with ₹518535 and Zone I (Wheat-Maize) upto ₹92072. The major amount was spent on machinery followed by livestock, farm building, and irrigation structure. An inverse relationship between net farm income per ha and the farm size held true in case of Punjab agriculture. The net farm income per ha was found to be ₹62727 on large farms as compared to ₹156880 per ha on marginal farms.

REFERENCES

Khatkar, R.K., Singh, V.K., Bhatia, J.K., & Singh, G. (2013). Income, saving, investment and consumption pattern on farm households in Haryana. *Indian Journal of Economics and Development, 9*(1), 1-10.

Saini R. (2017). *An economic analysis of investment pattern on Punjab farms* (Master's Thesis). Punjab Agricultural University, Ludhiana.

Singh, J., & Sidhu, R.S. (2005). Changing pattern of investments and its impact on growth in Punjab agriculture. *Journal of Agricultural Development and Policy*. *17*(1), 18-33.

Williamson, J.G. (1965). Regional inequality and the process of national development: A description of the patterns. *Economic Development and Cultural Change,13*(4), 3-45.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 336-346
DOI: 10.5958/2322-0430.2018.00079.3

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Asset Inequalities among Farm Households in Rural Punjab

Jasdeep Singh Toor[1], Gian Singh[2] and Naresh Kumar[3]*

[1]*Assistant Professor,* [2]*Professor, and* [3]*Ph.D. Scholar Department of Economics, Punjabi University, Patiala-147002 (Punjab)*

[*]*Corresponding author's email: jasdeeptoor22@gmail.com*

Received: January 20, 2018 *Manuscript Number: NS-18-122* *Revision Accepted: March 12, 2018*

ABSTRACT

The present paper attempted to analyze the prevailing disparity level in rural Punjab. An average Punjabi household owns durable assets worth ₹6.5 lakh. The durable assets reflect the socio-economic status of a household. Within the farming community, the average value of all the durable assets increases with the increase in farm-size. A residential building is the most valuable asset accounting for around 4/5th of the total household across the different categories. This implies that all the other durable assets account for only 1/5th of total durable assets. The durable assets are possessed maximum by the Large Farmers and minimum by the Agricultural Labourer category. The per-capita value of household durable assets is around 4 lakh for the Large Farmer category. Agricultural Labourer category owns household durable assets worth only 1/10th of assets of Large Farmer category. Among the farm assets, the asset value of tractor accounts for the largest proportion, followed by the value of electric tube wells. The respondents of Medium Farmer category have the per-capita value of farm assets worth nearly half of the Large Farmers' assets. Agricultural Labourer category assets are worth only 0.089 percent of the Large Farmers assets. The farm assets other than land account for 9.83 percent for an average sampled rural household. The livestock assets value is the highest for the Large Farmer category and lowest for Artisan category. Among the various constituents of livestock assets, the percentage share of buffaloes in milk is the highest andis positively associated with the farm-size. The second important livestock asset is cows in milk. Dogs and other livestock assets account for just 1/10th of the total livestock assets. The per-capita values of household durable assets clearly reflect that the Large and Medium Farmer categories are maintaining a comparatively better level of living than those under the other household categories. The socio-economic condition of the Agricultural Labourers is really miserable. The analysis of per capita values of farm assets clearly shows that the Large and Medium Farmer categories are relatively better placed as compared to the Marginal and Small Farmer categories due to the large size of their holdings. Economists agree on the fact that inequities of income and assets have harmful economic effects. Increased inequality, with top-heavy income distribution, may shorten growth duration, lessen aggregate demand (the rich tend to spend a smaller fraction of their income than the poor), hurting the poor, which can slow economic growth. Thus, decreasing the inequality levels also tend to promote higher and more stable development process, which, in turn, has the significant impact on the employment generation, reduction of poverty and have a smooth and sustainable development of agriculture sector.

Keywords
Agricultural labourer, assets, farm household.

JEL Codes
C81, D33, E25, J43, O15.

INTRODUCTION

The broad thought about Punjab agriculture sector is that it is extremely productive, have the potential for growth and gives good income to farmers. This thought might have been true during the early days of Green Revolution; the recent reports disclose some different trends about Punjab agriculture and the future of Green Revolution in the state. The productivity of rice and wheat is reported to have come near stability and farm income is reported to be stagnant and insufficient for a decent living. There is a growing realization about the degradation of land, water, and environment due to the current pattern of agricultural production and its sustainability is under question.

"Sustainable agriculture" is a concept that is both ambitious and ambiguous. The Food and Agricultural Organization (FAO) of the United Nations posits that sustainable agriculture (SA) has five major attributes: it is resource conserving (of land, water, plant, and genetic resources), environmentally non-degrading, technically appropriate, and economically and socially acceptable. Alternative conceptions emphasize profitability and economic feasibility (Kuyvenhoven and Ruben), social equity (Conway), community building and local participation (Chambers), social learning (Pretty & Uphoff), and other dimensions (Lee, 2005). Definitions of social equity can range from simple fairness and equal treatment to redistribution and reducing inequalities in society.

A major concern after the Green Revolution has been that whether the benefits of the increase in agricultural productivity and income are distributed more equitably within the rural society (Saini, 1976; Sarkar & Mehta 2010), especially to the poor farmers and households living in poverty and less favored environment. As in case of Brazil, it has developed a large-scale commercial agricultural system. Inequalities related to farm income have increased in the different regions of India (Chowdhary 1970; Nandal, 1972; Dhiman *et al*., 2015; Mishra *et al*., 2015; Bardhan, 1974; Paul, 1989). Inequalities like agricultural asset ownership have increased not only among the states but also among various land size groups (Laxminarayan, 1979; Rawal 2008). The large farmers have more agricultural assets like machinery as compared to the small and marginal farmers.

Achievement of complete equality is not possible as some of the economic inequalities may also be adding up to the development process. However, extreme inequalities may hamper the process of economic development and also de-stable the socio-political setup in the country. Economists agree on the fact that inequities of income and assets have harmful economic effects. Increased inequality, with top-heavy income distribution, may shorten growth duration, lessen aggregate demand (the rich tend to spend a smaller fraction of their income than the poor), which can slow economic growth. Also, the poorly designed efforts to lower inequality could grossly distort incentives and thereby, hurt even the poor. Thus, decreasing the inequality levels also tend to promote higher and more stable development process, which, in turn, has the significant impact on the employment generation, reduction of poverty and have a smooth and sustainable development of agriculture sector.

Assets are an important indicator of the economic well-being of households. Acquired through inheritance, gifts (including dowry) and accumulated savings, the assets provide means of livelihood as well as security against adverse economic shocks. In this context, the present paper attempts to analyze the prevailing inequality level in rural Punjab.

METHODOLOGY

The main objective of the present study is to examine the inequality in asset ownership among various farm size households as well as the agricultural labourer categories in rural Punjab and in light of that, to look into the feasibility of sustainable agriculture in Punjab. This paper uses primary data collected through a detailed schedule. To collect the data, Punjab state has been divided into three regions, namely Majha, Doaba, and Malwa. To avoid the geographical contiguity of sampled districts, Amritsar has been selected from Majha region and SBS Nagar (Nawanshahr) has been selected from Doaba region. Considering the sheer size of the region, the Malwa region has been divided into two sub-regions, Eastern Malwa and Western Malwa to give Malwa region a proper representation. Two districts, namely Mansa and SAS Nagar (Mohali) have been selected from these two regions, with SAS Nagar (Mohali) representing Eastern Malwa and Mansa representing the Western Malwa. On the basis of random sampling method, one village from each development block of the selected district has been selected. Thus, in all, twenty-two villages have been selected for the survey. A sample of 325 households involved in agricultural operations has been selected from the 23 villages of the Punjab state.

The analysis deals with the composition of assets of the rural households across the different categories.

Category-wise Value of Household Assets

Ownership of assets establishes the level of living of a household. The per household and per capita values of household assets of the different rural categories are provided in table 1. An average sampled household owns assets worth ₹1040849. The large farm size category has total assets of highest average value worth ₹4950715, followed by the medium farm size category having total assets worth ₹2347175, the small farm size category having total assets worth ₹1090968, the marginal farm size category having total assets worth ₹675180 and the agricultural labour category having assets worth ₹202438.

The per capita value of livestock assets is the highest (₹532908) for the large farm size category, followed by the medium farm size (₹386049), small farm size (₹211019), marginal farm size (₹132648) and the agricultural labour (₹41483) household categories. The values of assets appear to be highly correlated with the size of land they own.

The relative share of assets shows that household durables predominate in all the surveyed categories. The farm assets other than land account for 14.15 percent for the sampled household. This share is positively associated with the farmer. The proportionate share of livestock accounts for a relatively small share in all the surveyed rural categories. The relative share of livestock assets is 5.05 percent for rural household.

Household Durables Assets

Category-wise per household durable assets

Table 2 carries the data showing the average values of household durable assets of sampled households. The household durables include a dwelling house, electric fans/coolers/ACs, radio, washing machine, beddings,

Table 1. Category-wise value of household assets

(₹)

Assets	Marginal farm households	Small farm households	Medium farm households	Large farm households	Agricultural labour households	All sampled households
Household durables						
Per household	575473	875850	1843740	3831030	191849	841034
Per capita	113059	169410	303247	412382	39313	156036
Percentage	85.23	80.28	78.55	77.38	94.77	80.80
Farm assets						
Per household	46551	137882	393297	991699	3045	147239
Per capita	9146	26670	64687	106749	624	27317
Percentage	6.89	12.64	16.76	20.03	1.50	14.15
Livestock						
Per household	53157	77236	110138	127985	7544	52576
Per capita	10443	14939	18115	13777	1546	9754
Percentage	7.87	7.08	4.69	2.59	3.73	5.05
Total						
Per household	675180	1090968	2347175	4950715	202438	1040849
Per capita	132648	211019	386049	532908	41483	193107
Percentage	100	100	100	100	100	100

Source: Field Survey, 2015-16.

Table 2. Category-wise average value of household durable assets

(₹)

Assets	Marginal farm households	Small farm households	Medium farm households	Large farm households	Agricultural labour households	All sampled households
Dwelling house	485149	646531	1355957	2876471	169347	646958
Cots	4439	6727	9803	11265	2673	5342
Furniture	5568	10631	16502	33518	6327	9882
Music player	1180	1530	2532	5065	0	1196
T.V	3735	5172	6940	10727	2024	4190
Press	227	460	515	672	22	259
Washing machine	168	2976	5786	9293	48	1956
Coolers/Fans	5158	8474	12849	24735	1528	6552
Refrigerator	4570	6270	7723	11019	1194	4405
Generator/Inverter	1165	4712	11042	22712	0	3963
Sewing machine	666	1462	1205	1647	356	832
Phone: M/LL	1974	3647	7250	14833	1477	3544
Comp./Laptop	135	159	8989	21971	0	2511
Water filter	149	1223	3212	7498	0	1128
Motorcycle/Scooter/Bicycle	11326	24939	49285	51327	1360	17744
Jeep/Car	13311	40159	128043	294882	0	44757
Utensils	3831	5745	7549	11790	1464	4253
Bedding	6204	8507	11007	17036	2467	6486
Ornaments	24874	94721	195596	401824	524	73530
Gas	1644	1805	1956	2746	1038	1547
Total	575473	875850	1843740	3831030	191849	841034

Source: Field Survey, 2015-16.

utensils, car, motorcycle, television, etc. The average value of household durable assets is ₹841034 for the all sampled households. However, there are considerable variations in the per-household values of household durable assets across the different categories. The large farm size category has assets of highest average value worth ₹3831030, followed by medium farm size category having assets worth ₹1843740, small farm size category having assets worth ₹875850, marginal farm size category having assets worth ₹574458 and agricultural labour category having assets worth ₹191849. The estimated average durable asset value increases with the increase in farm-size within the farming community. A dwelling house household is the most valuable asset across the different categories, having an average value of ₹646958. This average value is the highest (₹2876471) for the large farm size category and the lowest (₹169347) for the agricultural labour category. As the durable assets reflect the socio-economic status of a household, these are possessed maximum by the large farmers and minimum by the agricultural labour. Thus, a clear trend is visible across the categories in this regard.

Category-wise structure of household durable assets

Table 3 provides a clear picture about the proportionate shares of household durable assets possessed by the different household categories. The table reveals that a dwelling house accounts for the highest (76.92 percent) value of total assets for the all sampled households. It is highest (88.27 percent) for the agricultural labour category, followed by the marginal farm size (84.30 percent), large farm size (75.08 percent), small farm size (73.82 percent) and medium farm size (73.54 percent) household categories. The percentage share of ornaments among the assets appears at the second place when all the sampled households are taken together. It is the highest (10.81 percent) for the small farmer category, followed by the medium farm size (10.61 percent), large farm size (10.49 percent), marginal farm size (4.32 percent) and agricultural labour (0.27 percent) household categories.

A jeep/car is the third important durable asset for the sampled household. This proportionate share is the highest (7.70 percent) for the large farm size category and the lowest (2.31 percent) for marginal farm size category, while agricultural labour households do not have any jeep/car. Next in order of importance are the relative shares of two-wheelers (2.11 percent), furniture (1.18 percent), coolers/fans (0.78 percent), bedding (0.77 percent), Cots (0.64 percent), refrigerator (0.52 percent), utensils (0.51 percent), TV (0.50 percent), etc. This ranking of assets is more or less same for different categories of sampled households. It is significant to note that the large farmers, due to their relatively higher

Table 3. Category-wise structure of household durable assets

(Percent)

Assets	Marginal farm households	Small farm households	Medium farm households	Large farm households	Agricultural labour households	All sampled household
Dwelling house	84.30	73.82	73.54	75.08	88.27	76.92
Cots	0.77	0.77	0.53	0.29	1.39	0.64
Furniture	0.97	1.21	0.90	0.87	3.30	1.18
Music player	0.20	0.17	0.14	0.13	0.00	0.14
T.V	0.65	0.59	0.38	0.28	1.06	0.50
Press	0.04	0.05	0.03	0.02	0.01	0.03
Washing machine	0.03	0.34	0.31	0.24	0.03	0.23
Coolers/Fans	0.90	0.97	0.70	0.65	0.80	0.78
Refrigerator	0.79	0.72	0.42	0.29	0.62	0.52
Generator/Inverter	0.20	0.54	0.60	0.59	0.00	0.47
Sewing machine	0.12	0.17	0.07	0.04	0.19	0.10
Phone: M/LL	0.34	0.42	0.39	0.39	0.77	0.42
Comp./Laptop	0.02	0.02	0.49	0.57	0.00	0.30
Water filter	0.03	0.14	0.17	0.20	0.00	0.13
Motorcycle/Scooter/Bicycle	1.97	2.85	2.67	1.34	0.71	2.11
Jeep/Car	2.31	4.59	6.94	7.70	0.00	5.32
Utensils	0.67	0.66	0.41	0.31	0.76	0.51
Bedding	1.08	0.97	0.60	0.44	1.29	0.77
Ornaments	4.32	10.81	10.61	10.49	0.27	8.74
Gas	0.29	0.21	0.11	0.07	0.54	0.18
Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: Field Survey, 2015-16.

income, possess more number of costly items such as refrigerator, cooler, air conditioner, television, ornaments, jeep/car generator, etc. compared to the other categories.

Category-wise per capita value of household durable assets

Since the family size is different for all the categories, it becomes relatively appropriate to study the per capita value of household durables of the different categories. The data collected in this regard is shown in table 4. It has been observed from the table that the per capita values of household assets are directly related to the farm-size within the farming community. The per capita value of household durable assets is ₹156036. The per capita value of household durable assets is the highest (₹412382) for the large farm size category, followed by the medium farm size (₹303247), small farm size (₹169410), marginal farm size (₹113059) and the agricultural labour (₹39666) household categories.

The per capita value of dwelling house is the highest (₹309631) for the large farm size category, followed by ₹223019 for medium farm size category, ₹125054 for small farm size category, ₹95314 for marginal farm size category and ₹34702 for agricultural labour category.

The per capita values of household durable assets across the different categories follow more or less the usual pattern. The per capita values of household durable assets clearly reflect that the large and medium farm size categories are maintaining a comparatively better level of living than those under the other six categories. The socio-economic condition of the agricultural labourer is really miserable.

Farm Assets

Farm assets play a vital role in generating farm income and creating employment opportunities. The households possess farm assets such as the tractor, trolley, farm buildings threshers, combine, diesel engine, spray pumps, fodder cutter, etc. These assets have led to transform the subsistence agriculture into commercial one for the large and medium farm size holdings.

Category-wise per household value of farm assets

The per-household values of farm assets are shown in table 5. The value of farm assets per household is ₹147239 for all sampled household. It can be observed that the increase in the farm size leads to an increase in the values of farm assets. The mean value of farm assets is ₹991699 for the large farm size category, whereas the similar value for the medium farm size category is ₹393297. For small and marginal farm size categories, the mean values of farm assets are ₹137882 and ₹4655 respectively. This

Table 4. Category-wise per-capita value of household durable assets

(₹)

Assets	Marginal farm households	Small farm households	Medium farm households	Large farm households	Agricultural labour households	All sampled households
Dwelling house	95314	125054	223019	309631	34702	120029
Cots	872	1301	1612	1213	548	991
Furniture	1094	2056	2714	3608	1297	1833
Music player	232	296	416	545	0	222
T.V.	734	1000	1141	1155	415	777
Press	45	89	85	72	4	48
Washing machine	33	576	952	1000	10	363
Coolers/fans	1013	1639	2113	2663	313	1216
Refrigerator	898	1213	1270	1186	245	817
Generator/Invertor	229	911	1816	2445	0	735
Sewing machine	131	283	198	177	73	154
Phone:M/LL	388	705	1192	1597	303	658
Computer/laptop	27	31	1478	2365	0	466
Water filter	29	236	528	807	0	209
Motorcycle/ scooter/bicycle	2225	4824	8106	5525	279	3292
Jeep/Car	2615	7768	21060	31742	0	8304
Utensils	753	1111	1242	1269	300	789
Bedding	1219	1646	1810	1834	506	1203
Ornaments	4887	18321	32170	43253	107	13642
Gas	323	349	322	296	213	287
Total	113059	169410	303247	412382	39313	156036

Source: Field Survey, 2015-16.

value is lowest (₹3045) for the agricultural labour category because they only have small human drawn implements, like axes, sickles, and spades other than the farm buildings.

Tractor, trolley, farm-buildings and electric tube wells accounted for a larger share of the farm assets. The mean value for the asset of the tractor is highest (₹492000) for the large farm size category, whereas the corresponding figures for the medium, small and marginal farm size categories are ₹207924, ₹88961 and ₹17230 respectively. The mean value for the asset of the trolley is the highest (₹87812) for the large farm size category, followed by the medium (₹36147), small (₹6444) and marginal (₹676) farm size categories. The values of farm buildings and electric tube wells are found to be positively associated with the farm size. The large farm size category has highest (₹99871) average value of farm buildings, followed by medium farm size category having asset worth ₹35426, marginal farm size category having asset worth ₹21554and small farm size category having asset worth ₹19460. It is concluded that as the farm size increases the need and ownership of farm assets also increases.

Category-wise structure of farm assets

The perusal of table 6 shows comparative shares of different constituents of farm assets. Among the constituents of farm assets, the value against the asset of tractor accounts for the largest proportion. Its relative share is 52.28 percent for the all sampled household. This proportion ranges from 37.01 percent for the marginal farm size category to 64.52 percent for the small farm size category. This percentage is 52.87 percent for the medium farm size category and 49.61 percent for the marginal farm size category. The value of farm buildings ranks second for all the farm size categories taken together.

This proportion is the highest (84.22 percent) for the agricultural labour category, followed by the marginal, small, large and medium farm size categories with their respective percentages of 46.30, 14.11, 10.07and 9.01. The trolley (7.62 percent) and electric tube wells (7.49 percent) ranks third and fourth respectively for an average farming household. Next in order of magnitude are the values of combine (4.07 percent) fodder-cutter (2.32 percent), reaper (2.19 percent), seed drills (2.16 percent), farm generators (2.14 percent), diesel engines (1.95 percent), harrow (1.73 percent), levelers (0.93 percent) and threshers (0.86 percent).

It is clear from the above analysis that tractors, farm buildings, electric tube wells, trolleys, reapers and combines, harrows and levelers are the items having the largest proportion of the total farm assets. The large and medium farm size categories have the number of such items as compared to the marginal and small farm size categories.

Category-wise per capita value of farm assets

It is clear from table 7 that per capita value of farm assets for the all sampled households stands at ₹27317,

Table 5. Category-wise average value of farm assets

(₹)

Assets	Marginal farm households	Small farm households	Medium farm households	Large farm households	Agricultural labour households	All sampled households
Farm buildings	21554	19460	35426	99871	2565	20006
Tractor	17230	88961	207924	492000	0	76972
Trolley	676	6444	36147	87812	0	11224
Harrow	311	2038	9219	14165	0	2540
Thresher	0	0	1170	20882	0	1262
Reaper	0	0	7899	39746	0	3221
Electric tubewells	1446	9524	24650	101176	0	11032
Fodder cutter	3744	4886	6927	9201	360	3420
Diesel engines	792	3002	9900	13009	0	2874
Farm generator	0	514	6621	40135	0	3157
Spray pumps	210	560	1104	2174	0	430
Leveller	97	1003	4836	8581	0	1365
Seed drills	0	767	10660	28501	0	3181
Combine	0	0	29787	32353	0	6000
Axe	87	146	237	400	36	117
Sickels	78	83	99	225	42	76
Spades	326	427	654	1396	41	340
Others	0	66	39	72	0	22
Total	46551	137882	393297	991699	3045	147239

Source: Field Survey, 2015-16.

Table 6. Category-wise structure of farm assets

(Percent)

Assets	Marginal farm households	Small farm households	Medium farm households	Large farm households	Agricultural labour households	All sampled households
Farm buildings	46.30	14.11	9.01	10.07	84.22	13.59
Tractor	37.01	64.52	52.87	49.61	0.00	52.28
Trolley	1.45	4.67	9.19	8.85	0.00	7.62
Harrow	0.67	1.48	2.34	1.43	0.00	1.73
Thresher	0.00	0.00	0.30	2.11	0.00	0.86
Reaper	0.00	0.00	2.01	4.01	0.00	2.19
Electric tubewells	3.11	6.91	6.27	10.20	0.00	7.49
Fodder cutter	8.04	3.54	1.76	0.93	11.84	2.32
Diesel engines	1.70	2.18	2.52	1.31	0.00	1.95
Farm generator	0.00	0.37	1.68	4.05	0.00	2.14
Spray pumps	0.45	0.41	0.28	0.22	0.00	0.29
Leveller	0.21	0.73	1.23	0.87	0.00	0.93
Seed drills	0.00	0.56	2.71	2.87	0.00	2.16
Combine	0.00	0.00	7.57	3.26	0.00	4.07
Axe	0.19	0.11	0.06	0.04	1.20	0.08
Sickels	0.17	0.06	0.03	0.02	1.39	0.05
Spades	0.70	0.31	0.17	0.14	1.35	0.23
Others	0.00	0.05	0.01	0.01	0.00	0.02
Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: Field Survey, 2015-16.

Table 7. Category-wise per-capita value of farm assets

(₹)

Assets	Marginal farm households	Small farm households	Medium farm households	Large farm households	Agricultural labour households	All sampled households
Farm buildings	4235	3764	5827	10750	526	3712
Tractor	3385	17207	34198	52960	0	14281
Trolley	133	1247	5945	9452	0	2082
Harrow	61	394	1516	1525	0	471
Thresher	0	0	192	2248	0	234
Reaper	0	0	1299	4278	0	598
Electric tubewells	284	1842	4054	10891	0	2047
Fodder cutter	736	945	1139	990	74	635
Diesel engines	156	581	1628	1400	0	533
Farm generator	0	99	1089	4320	0	586
Spray pumps	41	108	182	234	0	80
Leveller	19	194	795	924	0	253
Seed drills	0	148	1753	3068	0	590
Combine	0	0	4899	3483	0	1113
Axe	17	28	39	43	7	22
Sickels	15	16	16	24	9	14
Spades	64	82	108	150	8	63
Others	0	13	6	8	0	4
Total	9146	26670	64687	106749	624	27317

Source: Field Survey, 2015-16.

with the large farm size category having the highest per-capita value of ₹106749, followed by the medium farm size (₹64687), the small farm size (₹26670), the marginal farm size (₹9146) household categories. This value is ₹624 only for the agricultural labourer category.

The analysis of per capita values of farm assets clearly shows that the large and medium farm size categories are relatively better placed as compared to the marginal and small farm size categories due to their large size of holdings.

Livestock Assets

The livestock assets have appeared as the second most important productive asset of the rural households. These assets are not only a source of income for the farmers, but their nutritional needs are also fulfilled. The economic condition of the farmers also determined on this basis.

Category-wise per household value of livestock assets

The perusal of Table 8 revealed that the mean value of livestock assets is ₹52576 for the all sampled households. However, there are considerable variations in the values of livestock assets across the different categories. The livestock assets value is the highest (₹127985) for the large farm size category and lowest (₹7544) for the agricultural labour category. The livestock assets value is ₹110138 for medium farm size category, ₹77236 for small farm size category and ₹53157 for marginal farm size category. Both the buffaloes and cows account for a huge share of livestock assets. This share is positively associated with the farm size.

The share of buffaloes is the highest (₹92246) for the large farm size category and lowest (₹7222) for agricultural labour category, whereas the corresponding figures for the medium, small, marginal are ₹72786,₹62510, ₹57256 and ₹36034 respectively.

The share of cow is the highest (₹30176) for the medium farm size category, followed by the large, small and marginal farm size categories with their corresponding figures, ₹29235, ₹15123 and ₹14493 respectively. Next in order of magnitude are the values relating to the assets; others (₹2099) and young stock of cattle (₹942). The field survey has revealed the fact that in the case of large farm size category relatively higher value of livestock is the result of more number of livestock and their better quality.

Category-wise structure of livestock assets

Since the average values of livestock assets across the different categories are different, the pattern of livestock assets needs to be discussed in the relative terms. The structure of livestock assets is shown in table 9. Among the various constituents of livestock assets, the percentage share of buffaloes is the highest. This proportion comes to 71.15 percent for an average rural household. It is the highest (95.72 percent) for the agricultural labour category because they have only buffaloes and young stock of cattle and the lowest (66.09 percent) for the medium farm size category. The

Table 8. Category-wise average value of livestock assets

(₹)

Assets	Marginal farm households	Small farm households	Medium farm households	Large farm households	Agricultural labour households	All sampled households
Cows	14493	15123	30176	29235	0	12125
Buffaloes	36034	57256	72786	92246	7222	37410
The young stock of cattle	505	1484	2543	929	323	942
Others	2125	3373	4632	5574	0	2099
Total	53157	77236	110138	127985	7544	52576

Source: Field Survey, 2015-16.
**** Goats, sheeps, bees, dogs, working ox &bulls, hens, and cocks.***

Table 9. Category-wise structure of livestock assets

(Percent)

Assets	Marginal farm households	Small farm households	Medium farm households	Large farm households	Agricultural labour households	All sampled households
Cows	27.26	19.58	27.40	22.84	0.00	23.06
Buffaloes	67.79	74.13	66.09	72.08	95.72	71.15
The young stock of cattle	0.95	1.92	2.31	0.73	4.28	1.79
Others	4.00	4.37	4.21	4.36	0.00	3.99
Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: Field Survey, 2015-16.

percentage share of buffaloes is 74.13 percent for small farm size category, 72.08 percent for large farm size category and 67.79 percent for marginal farm size category.

The second important livestock asset is cows. This proportion constitutes 23.06 percent of the total livestock assets. The value of this asset is the highest for the medium farm size category (27.40 percent), followed by the marginal, large and small farm size categories with their corresponding figures, 27.26 percent, 22.84 percent and 19.58 percent respectively. Others appear at the third rank. Their relative share comes to 3.99 percent for an average rural household. The young stock of cattle contributes 1.79 percent to the total livestock assets for an average rural household. The large and medium farm size categories are better placed in this regard as compared to the all other categories.

Category-wise per capita value of livestock assets

The per capita values of the livestock assets are given in table 10. The perusal of table 10 reveals that per capita value of livestock assets is ₹9754 for the all sampled household. There are considerable variations in the per capita values of livestock assets across the different rural household categories. The per capita value of livestock assets is ₹10443 for the marginal farm size category, ₹14939 for the small farm size category, ₹18115 for the medium farm size category, ₹13777 for the large farm size category and ₹1546 for the agricultural labourer category.

The per capita value of cows is highest (₹4963) for medium farm size category, followed by the large farm size (₹3147), the small farm size (₹2925), and the marginal farm size (₹2847) household categories. The per capita value of buffaloes is highest (₹11971) for medium farm size category, followed by ₹11075 for small farm size category, ₹9930 for large farm size category, ₹7079 for marginal farm size category, ₹1480 for agricultural labourer category. The per capita values like per household value of livestock assets are directly related to the farm size.

CONCLUSIONS AND SUGGESTIONS

The structure of assets shows that household durables predominate in all the surveyed categories. The farm assets other than land account for 14.15 percent for the sampled household. This share is positively associated with the farm size. The proportionate share of livestock accounts for a relatively small share in all the surveyed rural categories. The relative share of livestock assets is 5.05 percent for rural household. The household durables of the sampled households include a dwelling house, electric fans/coolers/ACs, radio, washing machine, beddings, utensils, car, motorcycle, television etc. The average value of household durable assets is ₹8.5 lakh for the sampled households. The large farm size category has assets of highest average value, followed by the medium farm size, the small farm size category, the marginal farm size category and the agricultural labourer category. The value of all the durable assets increases with the increase in farm size within the farming community. A dwelling house is the most valuable asset across the different categories. An average sampled household is having the value of this asset worth around ₹6.5 lakh. It is the highest for the large farm size category and the lowest for the agricultural labourer category. The durable assets reflect the socio-economic status of a household. These are possessed maximum by the large farmers and minimum by the agricultural labourer category. Thus, a clear trend is visible in this regard. The relative share of assets shows that household durables predominate in all the surveyed categories.

Dwelling house accounts for 3/4th of the value of total assets for the sampled household. It is highest for the agricultural labourer category, followed by marginal farm size category, large farm size category, small farm size category and medium farm size category. The percentage share of ornaments among the household assets appears at the second place when all the sampled households are taken together. It is the highest for the small farm size category, followed by medium farm size category, large farm size category, marginal farm size category and agricultural labourer category. A jeep/car is the third important durable asset for the sampled households. The proportionate share of this asset is the highest for large farm size category and the lowest for marginal farm size category as agricultural labourer category do not have any jeep/car.

Next in order of importance are the relative shares of two-wheelers, furniture, bedding, coolers/fans/AC, cots,

Table 10. Category-wise per capita value of livestock assets

(₹)

Assets	Marginal farm households	Small farm households	Medium farm households	Large farm households	Agricultural labour households	All sampled households
Cows	2847	2925	4963	3147	0	2249
Buffaloes	7079	11075	11971	9930	1480	6941
The young stock of cattle	99	287	418	100	66	175
Others	417	652	762	600	0	389
Total	10443	14939	18115	13777	1546	9754

Source: Field Survey, 2015-16.

utensils, fridge, TV, etc. This ranking of assets is more or less same for different categories of sampled households. It is significant to note that the large farmers, due to their relatively higher income, possess the number of costly items such as refrigerator, cooler, air conditioner, television, ornaments, jeep/car generator, etc. compared to the other categories.

The per capita value of household durable assets is highest for the large farm size category, followed by medium farm size category, small farm size category, marginal farm size category, agricultural labourer category. The per capita values of household durable assets clearly reflect that the large and medium farm size categories are maintaining a comparatively better level of living than those under the other three categories. The socio-economic condition of the agricultural labourer is really miserable.

Among the constituents of farm assets, the value against the asset of tractor accounts for the largest proportion. Its relative share is 52.28 percent for the sampled household. This proportion ranges from 37.01 percent for the marginal farmer category to 64.52 percent for the small farmer category. The value of farm buildings ranks second for all the farm size categories taken together. This proportion is the highest for the agricultural labour category, followed by the marginal, small, large and medium farm size categories. The trolley and electric tube wells rank third and fourth respectively for an average farming household. Next in order of magnitude are the values of combines, fodder-cutter, reaper, seed drills, farm generators, diesel engines, harrow, levelers, and threshers.

The large farm size category has the highest per capita value of farm assets, followed by medium farm size category, small farm size category, and marginal farm size category. The analysis of per capita values of farm assets clearly shows that the large and medium farm size categories are relatively better placed as compared to the marginal and small farm size categories due to their large size of holdings.

The livestock assets value is the highest for the large farm size category and lowest for agricultural labourer category. Both the buffaloes and cows account for a huge share of livestock assets. This share is positively associated with the farm size. The share of buffaloes is the highest for the large farm size category. The share of cow is the highest for the medium farm size category, followed by the large, small and marginal farm size categories. Next in order of magnitude are the values relating to the assets; others and young stock of cattle. The field survey has revealed the fact that in the case of large farm size category relatively higher value of livestock is the result of more number of livestock and their better quality.

Among the various constituents of livestock assets, the percentage share of buffaloes is the highest. This proportion works out to be 71.15 percent for an average rural household. It is the highest for the agricultural labourer category because they have only buffaloes and young stock of cattle, and the lowest for the medium farm size category.

Achievement of complete equality is not possible as some of the economic inequalities may also be adding up to the development process. However, extreme inequalities may hamper the process of economic development and also de-stable the socio-political setup in the country. Economists agree on the fact that inequities of income and assets have harmful economic effects. Increased inequality, with top-heavy income distribution, may shorten growth duration, lessen aggregate demand (the rich tend to spend a smaller fraction of their income than the poor), which can slow economic growth. Also, the poorly designed efforts to lower inequality could grossly distort incentives and thereby, hurt even the poor. Inequality at the household level is much more evident in asset holding among the households involved in agricultural operations. Given this scenario, the objective of sustainable agricultural development is not likely to be attained in the near future. The idea of doubling farmer's income by 2022, which can only be achieved through sustainable agricultural development, is also not likely to be accomplished. The future of farm sector does not seem to be as pleasant as the picture is painted by the current regime. Thus, decreasing the inequality levels also tend to promote higher and more stable development process, which, in turn, has the significant impact on the employment generation, reduction of poverty and have a smooth and sustainable development of agriculture sector. Policymakers should focus on improving land titles and promoting equality in income and land distribution throughout the country. Efforts should be made for quality education in rural areas and school enrolment of underprivileged children should also be increased. There is a need to improve labour standards in the rural sector. For agricultural sustainability, livestock sector can be helpful if the better policy is made and provided with advance and affordable technology. Punjab must bring together its progressively productive and modern agricultural system with environmental conservation, social equality and poverty alleviation in rural areas.

REFERENCES

Bardhan, P.K. (1974). Inequality of farm incomes: A study of four districts. *Economic and Political Weekly, 9*(6-8), 301-308.

Chowdhary, B.K. (1970). Disparity in income in the context of HYV. *Economic and Political Weekly*, *5*(39), 90-96.

Dhiman, J., Dhiman, J.S., Aggarwal, R., & Dhiman, M. (2015). Water management for sustainability of irrigated agriculture: An Indian perspective. *Indian Journal of Economics and Development*, *11*(3), 601-622.

Laxminarayan, H. (1979). Inter size group and inter-state variations in distribution of agricultural assets. *Economic and Political Weekly, 14*(26), 69-74.

Mishra P., Sahu, P.K., Dhekale, B.S., & Vishwajith, K.P. (2015). Modeling and forecasting of wheat in India and its yield

sustainability. *Indian Journal of Economics and Development*,*11*(3), 637-648.

Nandal, D.S. (1972). Pattern of income, investment and saving of selected demonstration farms in Haryana. *Indian Journal of AgriculturalEconomics,27*(4),11-19.

Paul, S. (1989). Green revolution and income distribution among farm families in Haryana, 1969-70 to 1982-83. *Economic and Political Weekly, 24*(51-52), 154-158.

Rawal, V. (2008). Ownership holdings of land in rural India: Putting the record straight. *Economic and Political Weekly,43*(10), 43-47.

Saini, G.R. (1976). Green revolution and distribution in farm incomes. *Economic and Political Weekly, 11*(13), 17-22.

Sarkar, S. & Mehta, B.S. (2010). Income inequality in India: Pre and post-reform periods. *Economic and Political Weekly, 45*(37), 45-55.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 347-352
DOI: 10.5958/2322-0430.2018.00080.X

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Delivery and Transaction Costs of Agricultural Credit in Central Dry Zone of Karnataka

A. Jamaludheen[1] and V.R. Kiresur[2]*

[1]*Ph.D. Scholar, Division of Agricultural Economics, ICAR-IARI, New Delhi-110012*
[2]*Professor and Head, Department of Agricultural Economics, College of Agriculture, Vijaypur-586101*

[*]*Corresponding author's email: ajamaludheen@gmail.com*

Received: December 03, 2017 *Manuscript Number: NS-18-125* *Revision Accepted: February 18, 2018*

ABSTRACT

A broad vision for dryland agriculture would involve reducing poverty, hunger, and malnutrition and ensuring sustainable livelihoods for everyone. This vision can be achieved through a multi-pronged strategy to accelerate the pace of development of dryland agriculture, which requires synergies among innovative policies, appropriate institutional arrangements, market-driven technologies, input supplies and credit to benefit the dryland poor farmer. Multistage random sampling procedure was adopted to evaluate the objectives of the study. The Central dry zone (CDZ) of Karnataka was purposively selected for the study. From the zone, five taluks were chosen randomly. From each taluk, two villages were selected randomly. From each village, 10 farm households were chosen randomly. Descriptive statistics tools such as average, percent, ratio etc. were used to process the data for drawing meaningful conclusion. The study has revealed that borrowed amount, outstanding amount, interest rate and other transaction cost were highest in the case of long-term loans. Commercial banks were the leading institution with respect to all types credit disbursement in the study area, but share of cooperatives to the total crop or short-term loan disbursed in overall study area was highest (40percent) followed by regional rural banks and commercial banks (27.5 and 22.5percent, respectively). Further, about 85.94 percent of farmer-borrowers opined that the loan availed by them was adequate for the purpose, 89.06 percent expressed timely availability and easy accessibility of the loans, whereas 82.81 percent of them opined that the loan was availed at reasonable transaction cost. Necessary steps have to be taken by credit institutions in the form of special lending programmes for extending financial support to resource-poor dryland farmers in adopting improved technologies and thereby achieving better livelihood.

Keywords
Credit institutions, delivery, loan, transaction cost.

JEL Codes
C81, D23, E51, O13.

INTRODUCTION

Rainfed agro-ecologies contribute 55 percent to the net sown area and 66 percent to livestock. About 84-87 percent of pulses and minor millets, 80 percent of horticulture, 77 percent of oilseeds, 66 percent of cotton and 50 percent cereals are cultivated under the un-irrigated conditions. Dryland areas are complex, diverse, fragile, under-invested, risky, ethnic-economically unique, and distress prone. The Government of India has also constituted the National Rainfed Area Authority (NRAA) to give focused attention to the problems of rainfed areas of the country. Its mandate is wider than mere water conservation and covers all aspects of sustainable and holistic development of rainfed areas, including appropriate farming and livelihood system approaches.

The developments in the dryland region reflect the pervasiveness of poverty, which remains predominantly a rural phenomenonand which is demonstrated by the growing constraints on water, land degradation, continuing concerns about malnutrition, migration due to frequent droughts, lack of infrastructure, poor dissemination of improved technologies, effects of government policies and further economic liberalization on the competitiveness of dryland crops. A broad vision for dryland agriculture would involve reducing poverty,

hunger, and malnutrition and ensuring sustainable livelihoods for everyone. This vision can be achieved through a multi-pronged strategy to accelerate the pace of development of dryland agriculture, which requires synergies among innovative policies, appropriate institutional arrangements, market-driven technologies, input supplies and credit to benefit the dryland poor farmer.

The most relevant institutions are extension and credit institutions which are not able to meet the growing requirements of the farmers. Vyas (2004) pointed out that the blame of suicide by farmers in some parts of the country can be, at least partly due to the failure of the extension agencies who could not check spurious inputs or guide the farmers in the proper use of inputs, more so in rainfed areas. Greater emphasis on the seed sector, input use efficiency, financial and insurance institutions and a paradigm shift in technology transfer mechanisms can bring the dryland poor closer to food security.

Under this background, the present study has attempted to assess the financial support extended by various credit institutions in the study area in terms of credit delivery, transaction cost, access to credit, etc.

DATA AND METHODOLOGY

Multistage random sampling procedure was adopted to evaluate the objectives of the study. The Central dry zone (CDZ) of Karnataka was purposively selected for the study. From the zone, five taluks were chosen randomly. From each taluk, two villages were selected randomly. From each village, 10 farm households were chosen randomly. These respondents include all farmer categories such as small, marginal and large. The study relies mainly on primary data elicited from the rural households of the study area using a well-designed and pre-tested schedule. The descriptive statistics tools such as average, ratios, percent etc. were used to assess the credit delivery, transaction costs, outstanding amount etc.

RESULTS AND DISCUSSION

General Characteristics of Sample Respondents

The general characteristics of sample respondents are presented in Table 1. Average age of sample respondents in the study area indicated that majority of the farmers fall under middle age group (49 years). However, this average age was ranging from 39 years in C.N. Halli taluk to 54 years in Sira taluk. Average schooling years of respondents was impressive (7 years) and in particular, Hiriyur taluk farmers had more than 9 years of schooling. It was found that 100 percent of the respondents belonged to Hindu religion, so it can be assumed that Hindu religion was predominant in the study area. Caste composition data showed that OBC category was majority in the study area (55 percent) followed by general category (37percent). SC and ST respondents constituted very minor (6 and 2 percent) part of total respondents. Similar like the usual trend, number of males engaged in agricultural activity was more compared to females per family in the study area. Very meager number per family (2 percent) of children also engaged in some agricultural activities. Education status of respondents in the study area was impressive. More than 50 percent of members in a family were literates and among those literates majority of them completed matriculation level of education. Moreover, about 25 percent of those matriculates acquired graduation in various subjects. It was clear from the Table 1 that all the sample respondents (100 percent) in the study area were opted agriculture as main occupation for their livelihood. In addition to the main occupation, the respondents were engaged in some sort of subsidiary occupation such as petty business (3 percent), farm wage earners (13 percent) and non-farm wage earners (8 percent). However, majority of respondents (76 percent) do not have any such kind of subsidiary occupation which indicated that large majority respondents in the study area were chose agriculture as their exclusive livelihood option. The social participation of respondents was assessed in terms of ordinary and executive memberships in socio-political organizations. Active involvement and participation in such organizations brings out leadership ability in farmers and thereby innovativeness and adoption of improved technologies in their farms. In terms of organization categories, highest proportion of respondents (53.85 percent) was observed in participating in PACS which highlighted the importance of co-operative societies in farming sector of the study area.

Credit Delivery and Transaction Cost to Sample Farmers

The perusal of the Table 2 described the details of credit availed by sample farmers. The average loan amount borrowed by farmers with respect to all types of loan disbursed to the overall study area was about ₹1, 88,125 with rate of interest of 5.91 percent, other transaction cost other than interest of 1.05 percent and present outstanding amount of about ₹1,68,453. It was found that borrowed amount, outstanding amount, interest rate and other transaction cost were highest in the case of long-term loans. This could be due to the purpose of loan on which it was disbursed as well as the partial liquidating nature of the term loans. However, borrowed amount, outstanding amount, interest rate and other transaction cost were lowest in case of short-term loan because it had been largely disbursed for crop production purpose, hence the entire loan amount usually repaid in the same season or year (self-liquidating). Moreover, cooperative credit societies are the major institution dealing with this loans wherein the interest rate and other transaction costs are almost nil for the same. These results are in line with the findings of Satyasai (2008).

Opinions of Farmers on Access to Credit

The farmers' opinion on access to credit represented in Table 3 indicated that 85 percent of borrowers opined loans were adequate for the purpose for which they availed, 84.06 percent were expressed the loans were timely available as well as access to loans and 82.81

Table 1. General characteristics of sample respondents

Particulars	Chitradurga (n_1=20)	Hiriyur (n_2=20)	Davanagere (n_3=20)	Sira (n_4=20)	C.N. Halli (n_5=20)	Overall (N=100)	Overall (percent)
Age (Years)	49.40	52.45	48.25	54.45	38.70	48.65	
Education (Years)	5.45	9.25	6.95	6.20	9.00	7.37	
Caste							
SC	0	2	1	1	2	6	6.00
ST	2	0	0	0	0	2	2.00
OBC	10	14	13	13	5	55	55.00
General	8	4	6	6	13	37	37.00
Religion							
Hindu	20	20	20	20	20	100	100.00
Family Size(No.)							
Male	2.35	2.45	2.35	2.50	2.65	2.46	
Female	2.00	2.60	2.30	2.05	1.90	2.17	
Children	1.10	1.35	1.15	0.60	0.85	1.01	
Total	5.45	6.40	5.80	5.15	5.40	5.64	
Family members engaged in Agriculture							
Male	1.65	2.00	1.85	2.20	2.25	1.99	
Female	1.30	1.35	1.50	1.20	1.35	1.34	
Children	0.15	0.15	0.10	0.15	0.10	0.13	
Education Status							
Illiterates	2.60	1.45	2.35	1.55	1.60	1.91	
literates	2.85	4.95	3.45	3.60	3.80	3.73	
Matriculates	1.20	1.40	1.20	1.35	1.45	1.32	
Graduates	0.20	0.45	0.50	0.25	0.30	0.34	
Main Occupation							
Agriculture	20	20	20	20	20	100	100.00
Subsidiary Occupation							
Petty Business	1	1	1	0	0	3	3.00
Farm wage earner	3	2	1	5	2	13	13.00
Non- Farm wage earner	1	0	2	1	4	8	8.00
Not having any subsi. occupation	15	17	16	14	14	76	76.00
Social participation							
Elected/Nominated							
a) Membership	1	4	1	4	3	13	13.00
Of which:							
Ordinary	1	1	1	2	1	6	46.15
Executive	0	3	0	2	2	7	53.85
b) Organization							
Gram Panchayat	0	0	0	2	0	2	15.38
Multipurpose cooperative society	0	1	1	0	0	2	15.38
PACS	1	2	0	2	2	7	53.85
SHG	0	1	0	0	1	2	15.38
c) Title of executive membership							
Gram Panchayat member	0	0	0	2	0	2	28.57
President	0	2	0	0	1	3	42.86
Vice-President	0	1	0	0	0	1	14.29
Secretary	0	0	0	0	1	1	14.29

percent of farmer-borrowers agreed that loans were availed at reasonable transaction cost. This impressive opinion about credit access by borrowers could be due to the predominance of institutional agencies such as cooperatives, RRBs, commercial banks etc. for loan disbursement rather than private money lenders. These institutions should have to work based on some rules and regulations already laid down by the government which reduced exploitation in credit disbursement and enhanced the credit flowing to priority groups like small and marginal farmers. The results were in disagreement with the findings of Poulton *et al.* (2006).

Source-wise Credit Availed by Sample Farmers

It was observed from Table 4 that co-operatives were the major (40 percent) credit institution for disbursing short-term loan in the study area whereas commercial banks were the leading institution with respect to medium term (35.29 percent) and long-term (71.43 percent) loan disbursement. RRBs contribution also was by no means small in extending all kinds of loans in the overall study area. Nonetheless, commercial banks have emerged as the major source of credit in the study area irrespective of different types of loans. Various policy regulations brought by government over the years for priority sector lending particularly for vulnerable farming groups and restructured lending schemes by commercial banks in order to increase credit flow to the rural farming community would be the reasons for this pattern of disbursement of credit. The results of this study were found similar with the study of Kumar *et al.* (2010) wherein they reported that the structure of credit outlet has witnessed a significant change and commercial banks have emerged as the major source of institutional credit in recent years.

Source-wise Amount Borrowed and Amount Outstanding of Sample Farmers

The perusal of Table 5 revealed that average crop loan amount borrowed by farmers in the study area from money lenders was highest (₹2,33,333) followed by commercial banks and RRBs. and corresponding to that the outstanding amount also highest (₹2,03,333) in case of money lenders. However, in the case of medium-term loans commercial banks topped with an average borrowings of ₹2,70,833 and outstanding amount of ₹2,46,667which was followed by RRBs and similarly in the case of long-term loans also commercial banks

Table 2. Credit delivery and transaction cost to sample farmers

Type of loan	Particulars	Chitradurga	Hiriyur	Davanagere	Sira	C.N. Halli	Overall
Crop/Short-term loan	Amount borrowed (₹)	67222	100000	88636	56875	85000	80125
	Outstanding amount (₹)	67222	90000	69000	39000	90000	68900
	Year of availing (Year, Month)	2013	2013	2013	2013	2014	2013
	Rate of interest (percent)	1.67	9.10	4.18	2.00	18.50	5.13
	Transaction cost other than interest (percent)	1.18	0.95	0.93	1.31	0.33	1.04
Medium-term loan	Amount borrowed (₹)	600000	245000	230000	65000	152500	207941
	Outstanding amount (₹)	550000	197500	229000	66667	157500	195000
	Year of availing (Year, Month)	2014	2013	2013	2014	2014	2013
	Rate of interest (percent)	7.00	7.00	8.40	8.33	3.00	6.71
	Transaction cost other than interest (percent)	0.25	1.78	0.62	0.80	0.38	0.84
Long-term loan	Amount borrowed (₹)	-	3500000	466667	150000	100000	757143
	Outstanding amount (Rs)	-	3500000	283333	125000	110000	672857
	Year of availing (Year, Month)	-	2014	2013	2009	2003	2010
	Rate of interest (percent)	-	12.00	7.83	9.25	5.00	8.43
	Transaction cost other than interest (percent)	-	0.05	2.25	1.80	1.00	1.63
All type of loans	Amount borrowed (₹)	120500	365333	185526	73077	125714	188125
	Outstanding amount (₹)	115500	346000	144947	58615	131429	168453
	Year of availing (Year, Month)	2013	2013	2013	2013	2012	2013
	Rate of interest (percent)	2.20	8.73	5.87	4.58	7.71	5.91
	Transaction cost other than interest (percent)	1.08	1.11	1.06	1.27	0.45	1.05

Table 3. Opinions of farmers on access to credit

Type of Loan	Particulars	Chitradurga		Hiriyur		Davanagere		Sira		C.N. Halli		Overall	
		No	Percent	No	Percent	No	Percent	No	Percent	No	Percent	No	Percent
Crop/Short-term loan	No. of borrowers	9		10		11		8		2		40	
	Adequacy	9	100	9	90	7	63.64	4	50	2	100	31	77.5
	Timely availability	9	100	9	90	9	81.82	7	87.5	2	100	36	90
	Easy Access	9	100	10	100	9	81.82	6	75	2	100	36	90
	Reasonable transaction cost	6	66.67	9	90	9	81.82	5	62.5	2	100	31	77.5
Medium-term loan	No. of borrowers	1		4		5		3		4		17	
	Adequacy	1	100	4	100	5	100	3	100	4	100	17	100
	Timely availability	1	100	3	75	5	100	3	100	4	100	16	94.12
	Easy Access	1	100	3	75	5	100	2	66.67	4	100	15	88.24
	Reasonable transaction cost	1	100	4	100	5	100	3	100	4	100	17	100
Long-term loan	No. of borrowers	0	0	1		3		2		1		7	
	Adequacy	0	0	1	100	3	100	2	100	1	100	7	100
	Timely availability	0	0	1	100	2	66.67	1	50	1	100	5	71.43
	Easy access	0	0	1	100	3	100	1	50	1	100	6	85.71
	Reasonable transaction cost	0	0	1	100	2	66.67	1	50	1	100	5	71.43
All types of loans	No. of borrowers	10		15		19	633.33	13		7		64	
	Adequacy	10	100	14	93.33	15	500	9	69.23	7	100	55	85.94
	Timely availability	10	100	13	86.67	16	533.33	11	84.62	7	100	57	89.06
	Easy access	10	100	14	93.33	17	566.67	9	69.23	7	100	57	89.06
	Reasonable transaction cost	7	70	14	93.33	16	533.33	9	69.23	7	100	53	82.81

Table 4. Source-wise credit availed by sample farmers

Type of loan	Source	Chitradurga		Hiriyur		Davanagere		Sira		C.N. Halli		Overall	
		No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Crop/Short-term loan	Commercial Bank	2	22.22		0	3	27.27	3	37.5	1	50	9	22.5
	Cooperatives	6	66.67	2	20	4	36.36	4	50	-	0	16	40
	Money Lender	-	0	2	20	-	0	-	0	1	50	3	7.5
	RRB	-	0	6	60	4	36.36	1	12.5	-	0	11	27.5
	SHG	1	11.11	-	0	-	0	-	0	-	0	1	2.5
	Overall	**9**	100	**10**	100	**11**	100	**8**	100	**2**	100	**40**	100
Medium-term loan	Commercial Bank	1	100	1	25	3	60	1	33.33	-	0	6	35.29
	Cooperatives	-	0	-	0	-	0	-	0	3	75	3	17.65
	RRB	-	0	3	75	2	40	1	33.33	-	0	6	35.29
	SHG	-	0	-	0	-	0	1	33.33	1	25	2	11.76
	Overall	**1**	100	**4**	100	**5**	100	**3**	100	**4**	100	**17**	100
Long-term loan	Commercial Bank	-	0	1	100	2	66.67	2	100	-	0	5	71.43
	RRB	-	0	-	0	1	33.33	-	0	-	0	1	14.29
	SHG	-	0	-	0	-	0	-	0	1	100	1	14.29
	Overall	**-**	0	**1**	100	**3**	100	**2**	100	**1**	100	**7**	100

Table 5. Source-wise amount borrowed and amount outstanding of sample farmers

Type of Loan	Source	Amount Borrowed (₹)						Amount Outstanding (₹)					
		Chitradurg	Hiriyur	Davanager	Sira	C.N.Hall	Overal	Chitradurg	Hiriyur	Davanager	Sira	C.N.	Overal
Crop/Short-term	Commercial	125000		93333	10333	20000	95556	125000		96667	53333	20000	80000
	Cooperatives	54167	65000	55000	23750		48125	54167	65000	23500	23750		40250
	Money Lender		275000			150000	233333		225000			16000	203333
	RRB		53333	118750	50000		76818		53333	93750	57000		68364
	SHG	30000					30000	30000					30000
	Overall	**67222**	**100000**	**88636**	**56875**	**85000**	**80125**	**67222**	**90000**	**69000**	**39000**	**90000**	**68900**
Medium-term loan	Commercial	600000	250000	216667	12500		270833	550000	200000	200000	13000		246667
	Cooperatives					136667	136667					13666	136667
	RRB		243333	250000	40000		211667		196667	272500	55000		198333
	SHG				30000	200000	115000				15000	22000	117500
	Overall	**600000**	**245000**	**230000**	**65000**	**152500**	**207941**	**550000**	**197500**	**229000**	**66667**	**15750**	**195000**
Long-term loan	Commercial		350000	500000	15000		960000		350000	300000	12500		870000
	RRB			400000			400000			250000			250000
	SHG					100000	100000					11000	110000
	Overall		**350000**	**466667**	**15000**	**100000**	**757143**		**350000**	**283333**	**12500**	**11000**	**672857**

constituted major amount of farmers borrowing (₹9,60,000) followed by RRBs.

Though the co-operatives were the leading agency in crop loan disbursement in the study area, money lenders held first position in terms of average borrowed amount as well as average outstanding amount. This might be due to the usurious rate of interest charged by them, extending credit without any ceiling limit and imperfect loan disbursement without checking its end use as well as repaying capacity of farmer borrowers. The huge outstanding amount in case of term loans from various sources was due to its partial-liquidating nature. Similar findings were put forwarded by Vijaya kumar (2011).

CONCLUDING REMARKS

Commercial banks were the leading institution with respect to all types credit disbursement in the study area, but share of cooperatives to the total crop or short-term loan disbursed in overall study area was highest followed by regional rural banks and commercial banks. Further, about 85.94 percent of farmer-borrowers opined that the loan availed by them was adequate for the purpose, 89.06 percent expressed timely availability and easy accessibility of the loans, whereas 82.81 percent of them opined that the loan was availed at reasonable transaction cost. Necessary steps have to be taken by credit institutions in the form of special lending programmes for extending financial support to resource-poor dryland farmers in adopting improved technologies and thereby achieving better livelihood.

REFERENCES

Kumar, A., Singh, K.M., & and Sinha, S. (2010). Institutional credit to agriculture sector in India: Status, performance, and determinants, *Agricultural Economics Research Review, 23*, 253-264.

Poulton, C., Kydd, J., & Dorward, A. (2006). Overcoming market constraints on pro-poor agricultural growth in Sub-Saharan Africa. *Development Policy Review*, *24*(3), 243-277.

Satyasai, K.J.S. (2008). Rural credit delivery in India: Structural constraints and some corrective measures. *Agricultural Economics Research Review*, *21*(Conference Number), 387-394.

Vijayakumar, S. (2011). Dryland farming with special reference to Telangana, *National Seminar on Emerging Dimensions of Dry Land Farming.* Kakatiya University, Warangal, AP, India.

Vyas V.S. (2004). Agrarian distress: Strategies to protect vulnerable sections. *Economic and Political Weekly, 39*(52), 5576-5582.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 353-359
DOI: 10.5958/2322-0430.2018.00081.1

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Poverty among Scheduled Caste Households in Rural Punjab

Balwinder Singh Tiwana[1], Ravita[2], and Manpreet Kaur[3]*

[1]Professor, [2]Assistant Professor and [3]Research Scholar Department of Economics, Punjabi University, Patiala-147002

[*]Corresponding author's email: ravita85@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-127* *Revision Accepted: March 15, 2018*

ABSTRACT

In Punjab, the poor economic conditions of scheduled castes force them to survive with low standards of living. The social exclusion is viewed as the prominent reason for their poverty as a result of which these downtrodden people face certain obstacles to reap the benefits of sustainable development policies. The main objective of the present study is to analyze the levels of poverty and the factors affecting income and consumption based poverty among the scheduled caste households in the rural areas of Punjab. Multiple regression is used to explore the relationship between poverty and the different factors affecting it on the basis of their income and consumption patterns. The study is based on secondary data as well as primary data. The study explores that in Sri Muktsar Sahib district, the large portion of the scheduled caste households is living below poverty line with minimum necessities and facilities of life as compared to other two selected districts. The World Bank estimates of moderate poverty are quite high as compared to the Tendulkar Expert Group estimates and the incidence of poverty on the basis of per household's income and expenditure is more than poverty on the basis of per capita income and expenditure. The major factor influencing the income per capita of scheduled caste households is non-agricultural income whereas the major factor affecting consumption expenditure per capita is per person expenditure on education.

Keywords
Consumption expenditure, poverty, rural Punjab, social exclusion, sustainable development,

JEL Codes
E21, I32, P25, Q01, Z13.

INTRODUCTION

Globalisation has highlighted three main dimensions of the Indian economy: focus on efficiency and growth rather than growth with social justice; reducing the role of the State with great reliance on market forces and integrating the Indian economy to the world economy (Pandey, 2011). But, the division of Indian society into haves and have not's has resulted in the exclusion of specific castes from the process of social and economic development. This exclusion, as well as deprivation, is the foundation stone of poverty which has deepened its roots with the passage of time. The emergence of poverty is the major challenge for attaining sustainable development. Therefore, the curse of social exclusion has been viewed as the prominent reason of poverty as a result of which these downtrodden people face certain obstacles to reap the benefits of sustainable development policies.

In Punjab, the poor economic conditions of scheduled castes force them to survive with the low level of living. Their dependence on traditional and casual works leads to less income generation. To fulfill their basic daily needs, they usually take loans which convert into debt due to their non-repayment on time. This debt burden not only increases the inequalities in the development opportunities to this group but also hinders the growth process in the rural areas where a sizeable scheduled caste population is living (Singh, 2015). Further, low access to financial assets intensifies their poverty levels.In this regard, the scheduled castes must be addressed towards more sustainable and inclusive growth. As Punjab state has the high concentration of scheduled caste population, therefore, it is necessary to analyze their poverty levels in order to have an idea about their living standards and the access to financial resources.

OBJECTIVES AND METHODOLOGY

The main objective of the present study is to analyze

the levels of poverty among the scheduled caste households in the rural areas of Punjab. Along with this, an attempt has been made to examine various factors affecting their poverty levels based on their income and consumption patterns. Multiple regression is used to explore the relationship between poverty and the different factors affecting it on the basis of their income and consumption. According to this, more than one independent variables are used for estimating their relationship with dependent variables which include income and consumption. In other words, the factors affecting income and consumption based poverty are analyzed in the present study.

For the analysis of poverty levels of scheduled caste households in the rural areas of Punjab, both secondary and primary data have been used. The secondary data are used to select the districts, blocks, and villages. Based on the concentration of scheduled caste population, three selected districts with high, medium and low concentration are Sri Muktsar Sahib, Hoshiarpur, and SAS Nagar districts. Further, three development blocks from each district with high, medium and low concentration are selected. Three villages from each development block have been selected with a high, medium and low concentration of scheduled caste population. Thus, three districts, nine development blocks, and 27 villages have been selected for the analysis of the present study. In addition to this, primary data have been collected from 446 randomly selected scheduled caste households.

Levels of Poverty

As poverty comprises of subjective components along with its enumeration through objective factors, the estimation and conceptualization of poverty have prolonged to be a contentious issue. According to the general perspective, poverty is expressed as scarcity or lack of access to the minimum and basic requisites of human life which incorporate food to eat, clothes to cover body and shelter to live in. In India, the conceptual measurement of poverty is worked out on the basis of the poverty line. Here, the idea of a poverty line was first introduced by the Indian Labour Conference in 1957. Subsequently, in 1962, a poverty line was computed in India for the first time by the Working Group of the Planning Commission. This line is defined as the minimum expenditure that an individual has to incur to meet his/her basic needs. In other words, the poverty line reflects the ex-ante capability to fulfill a basket of basic human needs translated into a basket of goods and services evaluated at a given set of prices (Asian Development Bank, 2011). Thus, poverty, as explained in the context of the poverty line, is the dearth of minimum food as well as non-food requirements for a healthy sustenance.

In the past, the Planning Commission had constituted Expert Groups after a gap of about 12 to 15 years. This is evident from the chronology of the constitution of the Expert Groups since 1962 the earliest attempt by the Planning Commission to devise a methodology of poverty estimation. The Working Group submitted its report in the same year and the Planning Commission accepted its recommendations immediately. Fifteen years after the Working Group, the Planning Commission constituted a Task Force in 1977 under the chairmanship of Dr. Y. K. Alagh. The Task Force submitted its report in 1979 and the Planning Commission accepted its recommendations in the same year. Twelve years after the constitution of the Task Force and ten years after the acceptance of its recommendations, the Planning Commission constituted an Expert Group in 1989 under the chairmanship of Professor D. T. Lakdawala. This Expert Group submitted its report in 1993 and the Planning Commission accepted its recommendations in 1997. Then, eight years after the acceptance of its recommendations, the Planning Commission constituted the Expert Group under the chairmanship of Professor Suresh D. Tendulkar in 2005. This Expert Group submitted its report in November 2009 and the Planning Commission accepted its recommendations in January 2011. The Expert Group (Rangarajan) has been constituted seven years after the constitution of the Expert Group (Tendulkar), less than three years after the submission of its recommendations and only one and a half years after the acceptance of its recommendations (Planning Commission, 2014). Therefore, based on the recommendations of these expert groups, it is proposed to commence such policies and strategies which ensure inclusive growth in the continuously flourishing Indian society through reducing the poverty levels.

In the present study, an attempt has been made to evaluate the poverty levels of scheduled caste households residing in the rural areas of Punjab with respect to their income and consumption levels. Regardless the innumerable approaches to estimate poverty levels, the study takes into account two significant approaches which include the poverty line given by Tendulkar Expert Group and international measurement of the poverty line.

As per the assessment of Tendulkar Committee in the year 2011-12, in Punjab, persons having income/ consumption expenditure below ₹1054 per month per person in the rural areas are below poverty line (Planning Commission, 2014). The reference period of the study is 2013-14. For calculating poverty line in this time period, it is revised in accordance with the consumer price index for rural labourers for the year 2013-14. After calculation, this amounts to ₹1258 monthly per month and ₹15096 per annum.

Thereafter, World Bank has described moderate poverty with income/ consumption expenditure less than the US $3.10 per day per person whereas extreme poverty includes poor population living below the US $1.90 expenditure per day. The ratio of PPP conversion factor to market exchange rate has been used to calculate the exact value of US dollar in Indian rupees. Referred to as the

national price level, this ratio makes it possible to compare the cost of the bundle of goods that make up gross domestic product (GDP) across countries. It is the result obtained by dividing the PPP conversion factor by the market exchange rate (Walker, 2012). In 2014, the average exchange value of the dollar was ₹61.03 per US dollar whereas the Purchasing Power Parity was 16.94. Therefore, in India, this ratio was 0.3 (OECD, 2018). According to this ratio, PPP value of one US dollar is ₹18.31. As the international moderate poverty line is the US $3.10, therefore, determination of poverty line in the present study is ₹56.76 per person daily for which annual estimates are ₹20717 per person. As compared to this, the extreme poverty line is determined at ₹12698 per person annually (OECD, 2018a).

On the basis of income per household and consumption expenditure per household, Table 1 presents the percentage of scheduled caste households living below poverty line. As per the estimates of Tendulkar Expert Group, 36.10 percent households are living below poverty line with income less than ₹75480 annually whereas 60.31, and 23.09 percent households have an annual income less than ₹103585 and ₹63490 respectively which are considered as poor according to World Bank poverty line of US $3.10 and the US $1.90 per person per day respectively. On the basis of consumption expenditure per household, 31.17 percent households are living below poverty line as per Tendulkar Committee whereas 64.13 percent households are moderately poor and 18.39 percent households are extremely poor as per World Bank estimates.

The district-wise analysis reveals that the highest percentage of scheduled caste households living below poverty line is in Sri Muktsar Sahib district on the basis of income per household as well as consumption expenditure. Moreover, the percentage of moderately poor households is more according to World Bank estimates than the estimates of Tendulkar Committee whereas the percentage of extremely poor households having the income per household and consumption less than ₹63490 is very less. Thus, high level of poverty among scheduled caste households in Sri Muktsar Sahib district reveals their vulnerable condition. The table points out that in this district, about more than 60 percent households are moderately poor and the percentage of extremely poor households is 18.39, and 23.09 on the basis of consumption per household and income per household respectively. This is attributed to the lack of employment opportunities and low educational standards here. As compared to this, Hoshiarpur district shows fewer poverty levels due to more job opportunities in the non-farm and services sector along with the receipts of remittances which raise their living standards lowering the level of their poverty.

Further, on the basis of income per capita, 28.92 percent scheduled caste households are living below poverty line as per Tendulkar Committee whereas according to World Bank estimates, 53.14 percent households are moderately poor and 17.04 percent households are extremely poor among all the sampled households. In comparison to this, the consumption expenditure per capita reveals that 24.66 percent households are poor according to Tendulkar Committee whereas 60.54, and 10.31 percent households are poor as per the US $3.10 per day and the US $1.90 estimates.

Sri Muktsar Sahib district shows the maximum level

Table 1. Percentage of scheduled caste households living below poverty line (on the basis of per households and per capita)

District Poverty Line	SAS Nagar	Hoshiarpur	Sri Muktsar Sahib	All sampled households
On the basis of total income per household				
As per Tendulkar Committee	20.31	29.31	50.00	36.10
As per the US $3.10 per day	47.66	54.31	71.78	60.31
As per the US $1.90 per day	9.38	20.69	33.17	23.09
On the basis of total consumption expenditure per household				
As per Tendulkar Committee	19.53	28.45	40.10	31.17
As per the US $3.10 per day	60.94	56.90	70.30	64.13
As per the US $1.90 per day	10.94	13.79	25.74	18.39
On the basis of total income per capita				
As per Tendulkar Committee	24.22	25.86	33.66	28.92
As per the US $3.10 per day	48.44	47.41	59.41	53.14
As per the US $1.90 per day	9.38	16.38	22.28	17.04
On the basis of total consumption expenditure per capita				
As per Tendulkar Committee	24.22	19.83	27.72	24.66
As per the US $3.10 per day	64.84	50.86	63.37	60.54
As per the US $1.90 per day	10.94	6.90	11.88	10.31

Source: Primary Survey, 2013-14.

of poverty among scheduled caste households on the basis of income per capita whereas it is maximum in SAS Nagar district on the basis of consumption expenditure per capita. Also, Tendulkar Expert Group estimates are more in comparison to the US $3.10 World Bank estimates of poverty. On the whole, per household poverty is higher than per person poverty as per both the estimates which signifies the extremely poor conditions of the scheduled caste households in the rural areas of Punjab.

Factors Influencing Income-based Poverty

For determining the factors influencing the income of scheduled caste households, multiple regression model is used. As per this model, there are more than one independent variables for estimating its relationship with dependent variables. The dependent variable, also known as the explained variable, is the variable which is to be predicted whereas the independent or the explanatory variable is used to evaluate the variable of interest. The model is explained as under:

$$Y= ax_1b^1x_2b^2\ldots\ldots\ldots x_nb^n$$

where 'Y' is explained or dependent variable, 'a' is constant, 'x_1, x_2,……x_n' are the independent or explanatory variables and 'b^1, b^2,……, b^n' constitute regression coefficients which represent the change in dependent variable Y for a unit change in independent variables.

In the present study, the following dependent and independent variables have been selected:

$$Y= f(x_1, x_2, x_3, x_4, x_5)$$

Where Y= income per capita

x_1= No. of earners and earning dependents in the household

x_2= per capita assets

x_3= per capita non-agricultural income

x_4= no. of family members in the household or family size

x_5= consumption expenditure per capita on education

On the basis of these variables, regression has been calculated to have an idea about the variations across scheduled caste households in the rural areas of Punjab (Table 2).

The number of earners in scheduled caste households in all the selected districts have the positive relationship with income per capita of the household. Moreover, regression coefficient indicates significance at 10 percent level in SAS Nagar district and one percent each in Sri Muktsar Sahib district and all sampled households whereas it is non-significant in Hoshiarpur district.

Similarly, the value of per capita assets has affirmative relation with the income level of scheduled caste households in three surveyed districts of Punjab. In SAS Nagar and Sri Muktsar Sahib districts, the value of regression coefficient is significant at one percent level whereas it is statistically significant at five percent level in Hoshiarpur district. Thus, the assets contribute significantly to the income level of scheduled caste households.

Further, considering the non-agricultural income of the scheduled caste households is a positive indicator for increasing their income per capita. In all three selected districts, the regression coefficients and t-values are significant at one percent level. It explains that one percent increase in per capita non-agricultural income would lead to 0.65, 0.84, and 0.53 percent increase in income per capita in SAS Nagar, Hoshiarpur, and Sri Muktsar Sahib districts respectively. It points out the fact that non-agricultural income, either services in SAS Nagar and Hoshiarpur districts or wage work in Sri Muktsar Sahib district, is the major determinant for perking up income per capita of the scheduled caste households which is attributed to the lack of land as a major asset of scheduled caste households in rural Punjab.

Table 2. Factors influencing income-based poverty

District Determinants	SAS Nagar	Hoshiarpur	Sri Muktsar Sahib	All sampled households
No. of earners in the family	0.134*	0.010NS	0.164***	0.160***
	(1.848)	(0.197)	(2.711)	(4.728)
Value of per capita assets	0.187***	0.097**	0.243***	0.150***
	(2.882)	(2.102)	(4.423)	(4.790)
Per capita non-agricultural income	0.659***	0.844*	0.534***	0.681***
	(10.120)	(16.966)	(10.039)	(21.105)
Family size	-0.506***	-0.278***	-0.352***	-0.407***
	(-6.623)	(-5.708)	(-5.641)	(-11.865)
Per capita expenditure on education	-0.080NS	-0.053NS	0.016NS	-0.006NS
	(-0.127)	(-1.040)	(0.291)	(-0.195)
R^2	0.540	0.770	0.453	0.587
Adjusted R^2	0.521	0.760	0.439	0.582

Source: Primary Survey, 2013-14.
Figures in parentheses represent t-values.
******, **, and * Significant at one, five and ten percent level.***
NS: Non-significant.

In all the districts and all sampled households, family size is negatively related to the income per capita of scheduled caste households which points out the fact that more family members are a constraint for increasing the income level of the household. Along with this, the expenditure on education has also negative sign except in Sri Muktsar Sahib district where expenditure in education can result in the increase in the level of income. But, the t-values are non-significant in all three selected districts as well as all sampled households.

Overall, the coefficient of determination has values 0.540, 0.770, 0.453 and 0.587 in SAS Nagar, Hoshiarpur, Sri Muktsar Sahib districts and all sampled households which represents the goodness of fit, that is, the observed data matches the expected values. These values of R^2 justify the fact that the independent variables explain about 54, 77, 45, and 58 percent variations in the analysis of income per capita respectively. To put in plain words, non-agricultural income followed by assets is the major determinant for uplifting the income of scheduled caste households in the rural areas of Punjab.

Factors Influencing Consumption-based Poverty

In addition to this, multiple regression model is used to determine the factors affecting the consumption expenditure of scheduled caste households. The similar model is used which is explained as under:

$$Y= ax_1b^1x_2b^2\ldots\ldots\ldots x_nb^n$$

Where 'Y' is explained or dependent variable, 'a' is constant, '$x_1,x_2,\ldots\ldots\ldots x_n$' are the independent or explanatory variables and 'b^1, b^2,……, b^n' constitute regression coefficients which represent the change in dependent variable Y for a unit change in independent variables.

In the present study, the following dependent and independent variables have been selected to analyze the determinants of consumption-based poverty:

$$Y= f(x_1, x_2, x_3, x_4, x_5)$$

where Y= consumption expenditure per capita

x_1= No. of dependents

x_2= Income per capita

x_3= Per capita productive assets

x_4= No. of earning and earning dependents in the household

x_5= consumption expenditure per capita on education

On the basis of these variables, regression has been calculated to have an idea about the variations across scheduled caste households in the rural areas of Punjab (Table 3).

Firstly, the number of dependents in the household has the negative relationship with the level of consumption expenditure. Its t-value is not significant at any level. This relationship is negative in case of SAS Nagar and Sri Muktsar Sahib districts and it is positive in Hoshiarpur district. This means that increase in the number of dependents would increase the consumption level in Hoshiarpur district only.

Overall, the regression coefficient is positive showing direct relationship between income per capita and consumption expenditure. The same case is visible in SAS Nagar and Hoshiarpur districts whereas this relationship is inverse in Sri Muktsar Sahib district. The values of regression coefficient are statistically significant at one percent level in Hoshiarpur and Sri Muktsar Sahib districts whereas regression coefficient is significant at five percent level in SAS Nagar district.

Further, the increase in per capita productive assets is positively related to consumption expenditure among all the sampled households as well as in SAS Nagar and Sri Muktsar Sahib districts. This relationship is negative in Hoshiarpur district which indicates that a unit increase in per capita productive assets would lead to the reduction in consumption expenditure per capita. This validates Engel's law of consumption which explains that with an increase in income, the consumption expenditure on

Table 3. Factors influencing consumption-based poverty

District Determinants	SAS Nagar	Hoshiarpur	Sri Muktsar Sahib	All sampled households
No. of dependents	-0.019^{NS}	0.007^{NS}	-0.136^{***}	-0.064^{NS}
	(-0.216)	(0.072)	(-1.849)	(-1.339)
Income per capita	0.203^{**}	0.264^{***}	-0.190^{*}	0.245^{***}
	(2.230)	(2.707)	(-2.559)	(5.031)
Per capita productive assets	0.088^{NS}	-0.030^{NS}	0.043^{NS}	0.005^{NS}
	(1.004)	(-0.333)	(0.600)	(0.117)
No. of earners	-0.065^{NS}	0.035^{NS}	-0.145^{**}	-0.034^{NS}
	(-0.745)	(0.368)	(-2.036)	(-0.736)
Per capita expenditure on education	0.232^{***}	0.159^{*}	0.245^{***}	0.203^{***}
	(2.629)	(1.664)	(3.477)	(4.318)
R^2	0.139	0.116	0.164	0.135
Adjusted R^2	0.103	0.076	0.140	0.124

Source: Primary Survey, 2013-14.
Figures in parentheses represent t-values.
******, **, and * Significant at one, five and ten percent level.***
NS: Non-significant.

necessities of life such as food items goes on decreasing. The values of regression coefficient are not significant at any level.

The number of earners in the family show inverse relationship with consumption expenditure in SAS Nagar and Sri Muktsar Sahib districts whereas the case is opposite in Hoshiarpur district. Here, increase in the number of earners would lead to increase in consumption expenditure of scheduled caste households. The regression coefficients are non-significant at any level of significance in SAS Nagar and Hoshiarpur districts whereas it is statistically significant at five percent level in Sri Muktsar Sahib district.

The consumption expenditure per capita and per person expenditure on education is positively related in all three selected districts and all surveyed households. One percent increase in expenditure in education would lead to 0.23, 0.25, and 0.20 percent increase in consumption expenditure in SAS Nagar and Sri Muktsar Sahib districts and all sampled households respectively. Also, the regression coefficients are significant at ten percent level of significance in Hoshiarpur district.

The values of coefficient of determination, that is, R^2 indicate the goodness of fit and the independent variables explain 13, 11, 16, and 13 percent of variations in the assessment of consumption expenditure per capita in SAS Nagar, Hoshiarpur, Sri Muktsar Sahib districts and all sampled households respectively. The respective values of adjusted R^2 are 0.103, 0.076, 0.140 and 0.124. Inclusively, per person expenditure on education followed by income per capita are the two major factors influencing the consumption expenditure of scheduled caste households in rural Punjab.

CONCLUSION AND POLICY IMPLICATIONS

To conclude, it can be said that in the rural areas of Punjab, the scheduled caste households are living in extremely poor conditions. In Sri Muktsar Sahib district, the large portion of them is living below poverty line with minimum necessities and facilities of life. The condition of scheduled castes in Hoshiarpur district is relatively better due to their relatively better employment and high-income levels as compared to other two districts. The World Bank estimates present high levels of moderate poverty as compared to the Tendulkar Expert Group estimates of poverty. The poverty on the basis of per household income and expenditure is more than the poverty on the basis of per capita income and expenditure among the scheduled caste households in the rural areas of Punjab. The regression analysis reveals that the major factor affecting the income per capita of scheduled caste households is non-agricultural income whereas per person expenditure on education is the major factor affecting per person consumption expenditure.

The scheduled castes form the most underprivileged section in the rural regions of Punjab. For the welfare and prosperity of this vulnerable section of the society, the government has an influential liability. Along with this, the comprehensive strategy needs to be followed for addressing the social exclusion and their inclusion in the social and economic undertakings. The various policy inferences for overcoming the poverty among scheduled castes in the rural areas of Punjab can be put in plain words as below:

The analysis of the study reveals that scheduled caste households survive in extremely poor conditions having the high incidence of poverty. The major reasons for their high poverty levels include lack of assets, low educational attainments, high dependence on wage labour and lack of access to financial and income-generating resources. Moreover, the scheduled caste households in Sri Muktsar Sahib district are more vulnerable as compared to other two selected districts. In this regard, it is mandatory to execute the anti-poverty programmes at the grassroot level and enhance transparency in their effective functioning. Cent percent disposal of these schemes to the deprived persons must be the prime responsibility of the government. Record management systems must be strengthened to provide adequate data on the basis of gender, caste etc. so that distribution of funds can reach the people in packages rather than in slices.

The study points out that non-agricultural income contributes large share for raising the income levels of scheduled castes which can reduce the poverty among them. In this regard, the major effort of the government policies is to integrate their traditional occupations with the new subsidized technology. As rural Punjab is agriculturally developed, therefore, employment in the agro-based industries can develop the non-farm sector activities among the scheduled castes. Enhancement of entrepreneurship is another big step for lowering their poverty levels through which they can be made capable of running the small business.

Assets also have the positive relationship with income and consumption levels of scheduled caste households in the rural areas of Punjab. The access to income-generating assets is the prominent factor through which they can come out of poverty and raise their living standards. But, the scheduled castes lack the ownership of land and their access to other assets is also limited. Therefore, an attempt should be made to give preferential treatment to the scheduled castes in the allotment of surplus land in the villages and they must be provided with necessary equipment and inputs for the production of crops on that land. Also, livestock is an important asset through which, they could supplement their daily income.

Along with this, increase in expenditure on education can be beneficial for the scheduled caste households for increasing their income. Their poverty levels can be reduced to a great extent if they have access to human development resources. Emphasis should not be on the enrollment of students in education, rather focus should be on the human resource development through high educational qualification of these people. Reservations in private schools along with the government ones can be of

great help for the inclusion of the excluded groups. Attainment of education can be fruitful for them to find the white collar jobs and come out of the chains of poverty and deprivation.

The study clearly demonstrates that the number of dependents among scheduled castes can aggravate their poverty levels by reducing the income per capita. Therefore, the government should initiate programmes to provide employment opportunities to the needy people according to their capability, that is, the uneducated people must be provided labour work under various government initiatives such as MGNREGS and the educated persons among them should be given white collar jobs as per their educational attainments.

REFERENCES

Asian Development Bank. (2011). *Understanding poverty in India*. New Delhi: Asian Development Bank.

OECD. (2018). Exchange rates (indicator). doi: 10.1787/037ed317-en. Retrieved from https://data.oecd.org/conversion/exchange-rates.htm.

OECD. (2018a). Prices and purchasing power parities (PPP) (Indicator). Retrieved from www.oecd.org/sdol/prices-ppp/.

Pandey, M.T. (2011). Globalisation and social transformation in India: Theorising the transition. *International Journal of Sociology and Anthropology*, 3 (8), 253-260.

Planning Commission. (2014). *Report of the expert group to review the methodology for measurement of poverty.* New Delhi: Government of India, Planning Commission.

Singh, B. (2015). *Socio-economic conditions of scheduled caste households in rural Punjab.* Major Research Project. New Delhi: Indian Council of Social Science Research.

Walker, J.R. (2012). Clarification of PPP. Retrieved from http://www.ssc.wisc.edu/~walker/wp/wp-content/uploads/2012 /09/E448PPP binder.pdf

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 360-365
DOI: 10.5958/2322-0430.2018.00082.3

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Credit for Investment: Its Magnitude and Sources in Punjab Agriculture

Rohit Saini[1] and Raj Kumar[2]*

[1]Research Scholar and [2]Extension specialist (Farm Management), Department of Economics and Sociology
Punjab Agricultural University, Ludhiana-141004

[*]Corresponding author's email: rohitsaini-aes@pau.edu

Received: January 15, 2018 *Manuscript Number: NS-18-144* *Revision Accepted: March 10, 2018*

ABSTRACT
Credit plays an important role in the development of agriculture. A sample of 150 farmers was taken with 23, 28, 46, 43 and 10 farmers selected from marginal, small, semi-medium, medium and large farm size categories respectively. The share of borrowed funds in the total investment was 43.19 percent. In borrowed funds, share of institutional and non-institutional credit was 65.98 and 34.02 percent respectively. Share of non-institutional credit was significant so it was suggested that government may regularized working of non-institutional credit agencies to keep check on their working. Problems faced by the farmers in availing institutional credit were non-cooperative attitude of staff of revenue department, offering security and rigid repayment plan and in case of non-institutional credit were high rate of interest, offering security and inadequate amount. Reasons for opting non-institutional sources of credit were no paperwork, secrecy, and easy access.

Keywords
Institutional and non-institutional credit, investment, sources of credit.

JEL Codes
C81,E51, O16.

INTRODUCTION

Credit plays an important role in the development of agriculture. With the inception of green revolution, the need for the agricultural credit increased. The green revolution model introduced in mid-1960's changed the subsistence farming practices of the farmers and replaced it with market-driven farming. In this phase, the financial requirements of the farmers surged which increased their dependency on outside funding. Farming demands regular outflow of cash to acquire various agricultural inputs but the inflow of the same is not continuous due to seasonal nature of agriculture. The gap so created is plugged-in by borrowed funds either from institutional or non-institutional sources. So, credit facilitates farmers to undertake new investments. The demand for credit varies from region to region, activity to activity, borrower to borrower making financing to an individual a unique case. For investment purposes, the agencies assess the credit requirement and satisfy themselves that financed activity will generate enough income so that loan will be returned by the farmer. The loan may vary from borrower to borrower depending upon the size of the unit, techno-economic parameters and also the entrepreneurial skills of the borrower.

Formal as well as informal sources of credit have been catering to the needs of the farmers. Lack of sufficient and timely finance has been the bane of the Indian agriculturists. In India, 83 percent of the farmers are small and marginal who are unable to save due to low level of income but the amount required to invest in agriculture is higher. Small, marginal and landless farmers take credit for investment and production purposes as well as to meet consumption purposes and social obligations. But there are instances when they are unable to repay the loan which leads to farm indebtedness thus, causing problems like stress, drug addiction, suicide, bonded labor, etc. To overcome these problems, government has taken various measures like revival and growth of cooperatives, nationalization of banks, debt waiver schemes, etc. Institutional credit has been used as an important policy instrument for growth and development of the agriculture sector in India.

It is well known that the diffusion of green revolution in ecologically favourable regions of India was mainly facilitated by the institutional credit system by providing large amount of investment and production credit to the farmers. Credit disbursement to agriculture sector has increased from ₹86.98 thousand crore in 2003-04 to ₹8.45 lakh crore in 2014-15 (Directorate of Economics and Statistics, 2016).The green and white revolution, development of horticulture, plantation, poultry, fisheries, and oilseeds has been facilitated by it. The strategy devised for the purpose has been resting upon three pillars: expansion of institutional structure, direct lending to disadvantaged borrower and lower interest rates. The demand for agricultural credit in India is anticipated to grow considering the high growth in the agricultural sector, greater market orientation, and the emerging importance of subsidiary activities.

Farmers have access to various non-institutional source of credit also. Of all the non-institutional sources, *arthiyas* are most popular source of credit. These agents act as middlemen for sale of the crop as well as credit financer to farmers. Their working can be simplified by saying that they give credit according to requirements of the farmers for gestation period of crop and collect it along with the interest at the time of the sale of the produce. Other major sources of the non-institutional credit are landlords, friends, relatives, etc. Access to formal credit is tilted toward the large farmers as marginal and small farmers are considered as risky customers due to their less repaying capacity. With limited or no access to institutional finance, people with low repaying capacity may resort to informal financial sector like money lenders or borrowing from friends and relatives when in dire need of money and at most of the times are unable to repay on time. Moneylenders often resort to harassing the borrowers to get back his loans. Farmers have been exploited by all these non-institutional structures of the credit by charging exorbitant rate of interest, other malpractices prevailing due to lack of transparency and fixed rules. Illiteracy and ignorance of farmers, especially in credit transactions has been bane for Indian farmers.

Contrary to the problems face by marginal and small farmers, even well-off farmers which have capacity to fulfill needs of the family and still left with some amount to invest in agriculture, there are certain technologies which are beyond their reach also. For all these investments the need of the credit has been observed by the policymakers. Investment decisions are generally connected with financial position of an individual and access to lending agencies. The capital investment by borrowing fund is quite a common practice in agriculture. Capital formation in agriculture is dependent on availability of credit (Dhawan & Yadav, 1995). In the present study, we will examine the role of institutional and non-institutional sources of finance in farm investment and the problems faced by farmers in availing credit.

METHODOLOGY

The data used for the study has been collected from three agro-climatic zones of Punjab. A multistage random sampling technique was used for selection of sample farm households. At the first stage of sampling, one district from each agro-climatic zone was selected randomly. Hoshiarpur from Zone-I, Ludhiana from Zone-II and Bathinda from Zone-III were selected randomly. At the second stage of the sampling, one block from each selected district was selected randomly. In this way, Hoshiarpur I, Ludhiana II and Talwandi Sabo blocks were selected from Hoshiarpur, Ludhiana and Bathinda districts respectively. A cluster of villages was selected randomly from each selected blocks. A sample of 50 farmers was taken from each zone making the ultimate sample of 150 farmers in which 23, 28, 46, 43 and 10 farmers were selected from different farm size categories on the basis of the probability proportional to size (PPS). The primary data from the selected respondents was collected on a well designed and pre-tested schedule. The information pertaining to farm investment pattern like investments in farm machinery, implements, farm buildings, irrigation structure and livestock of sample households was collected. The information on contribution of different sources of finance for farm investments and various problems faced in obtaining credit from various sources was obtained along with the reasons for availing credit from non-institutional credit agencies. Simple tabular analysis tools were used for the analysis of data to attain the objectives of the study.

RESULTS AND DISCUSSION

Magnitude of Owned Funds and Borrowed Funds in Farm Investment

The magnitude of the investment on a farm and on a hectare in different farm size categories has been presented in the Table 1. The analysis of investment per farm revealed that on an average, amount invested was ₹868383 in which contribution of owned and borrowed funds was ₹493363 and ₹375020 respectively It was observed that the magnitude of amount invested, owned funds and borrowed funds increased as the farm size increased. The amount invested for marginal farm size category was ₹225574 in which contribution of owned and borrowed funds was ₹74052 and ₹151522 respectively and amount invested in case of large farm size category was ₹2470112 in which contribution of owned and borrowed funds was ₹1719112 and ₹751000 respectively.

The analysis of investment on per hectare revealed that on an average investment per hectare was ₹192546 in which use of owned and borrowed funds was ₹109393 and ₹83153 respectively. It was observed that amount invested per hectare decreased as the farm size increased so it can be concluded that the need of investment per hectare decreases as the farm size increases. This pattern may be observed due to economies of scale. When investment was broke up into owned and borrowed funds, it was found that marginal and small farmers used

borrowed funds more than owned funds, semi-medium farmers used owned funds and borrowed funds in equal proportion and medium and large farmers used owned funds more than borrowed funds. Use of owned and borrowed funds on marginal farms was ₹87120 and ₹17826 respectively while that on large farms was ₹110483 and ₹48265 respectively. It was found that as the farm size increased use of owned funds per hectare increased but borrowed funds per hectare decreased. It may be due to the higher income level of the larger farmers which enable them to use owned funds extensively and lower income level of small farmers which forces them to use borrowed funds.

Share of Owned and Borrowed Funds in Farm Investment

The share of owned funds and borrowed funds in the farm investments in Punjab has been presented in Table 2. On an average, owned and borrowed funds hold 56.81 and 43.19 percent share respectively in the total amount invested. While analyzing the different farm size categories, it can be observed that as the farm size increases the share of owned funds increases while the share of borrowed funds decreases. In case of marginal farms, borrowed had the maximum share (67.17 percent)in the total investment. It may be due to lack of owned funds that they have to use borrowed funds extensively for making farm investment. On the contrary, owned funds were extensively used by large farmers with 69.60 percent share in amount invested by them. These trends were observed due to higher availability of capital with large farmers which enable them to use owned funds extensively.

Magnitude of Institutional and Non-institutional Credit in Borrowed Funds

The magnitude of institutional and non-institutional credit in borrowed funds has been presented in Table 3. In the analysis of borrowed funds per farm,on an average**,** the amount of borrowed funds was ₹375020 in which institutional and non-institutional credit sources contributed ₹247420 and ₹127600 respectively. It was observed that as the farm size increased the amount borrowed as well as credit from institutional sources increased. The magnitude of the amount borrowed from non-institutional sources was similar in the range ₹1-₹1.5 lakh on all farm size categories except large farmers where it was ₹75000. It depicts that the large farmers rarely use non-farm credit sources for credit requirements. It may be due to the fact that large farmers can easily fulfill their credit needs from institutional credit sources. It was verified from the fact that the magnitude of institutional credit of large farmers was more than 10 times to that of marginal farmers. The

Table 1. Magnitude of owned and borrowed funds in farm investment, 2015-16

(₹)

Particulars	Farm size categories					Overall (N=150)
	Marginal (n_1=23)	Small (n_2=28)	Semi-medium (n_3=46)	Medium (n_4=43)	Large (n_4=10)	
Per farm						
Owned funds	74052	183543	385659	749550	1719112	493363
Borrowed funds	151522	239036	375978	494651	751000	375020
Amount invested	**225574**	**422579**	**761638**	**1244201**	**2470112**	**868383**
Per ha						
Owned funds	87120	109252	120143	104832	110483	109393
Borrowed funds	178261	142283	117127	69182	48265	83153
Amount invested	**265381**	**251535**	**237270**	**174014**	**158748**	**192546**

Table 2. Share of owned and borrowed funds in farm investment, 2015-16

(Percent share)

Particulars	Farm size categories					Overall (N=150)
	Marginal (n_1=23)	Small (n_2=28)	Semi-medium (n_3=46)	Medium (n_4=43)	Large (n_4=10)	
Owned funds	32.83	43.43	50.64	60.24	69.60	56.81
Borrowed funds	67.17	56.57	49.36	39.76	30.40	43.19
Amount invested	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

analysis of borrowed funds per hectare revealed that the use of borrowed funds in investment made on each hectare decreased as the farm size increased. In break-up of borrowed funds into institutional and non-institutional sources of credit, it was found that institutional credit (₹54860) was used extensively as compare to non-institutional sources (₹28293) for making investment. In different farm size categories, same trend was observed in semi-medium, medium and large farm size categories in which institutional credit was greater than non-institutional credit. However, in marginal and small farm size categories the use of non-institutional credit was more than institutional credit. The unavailability of desired amount of credit from institutional credit sources may be the reason that marginal and small farmers switched to non-institutional sources of credit.

Share of Institutional and Non-institutional Credit in Borrowed Funds

Borrowed funds play vital role in farm business. The source of credit can be either institutional or non-institutional. Share of institutional and non-institutional credit in borrowed funds has been presented in Table 4. On an average, institutional credit holds share of 65.98 percent and non-institutional credit holds share of 34.02 percent in the total borrowed funds. For institutional credit, maximum share was in large farm size category (90.01 percent) followed by medium farm size category (74.45 percent), semi-medium farm category (61.21 percent), small farm size category (43.15 percent) and the minimum share was of marginal farm size category (28.84 percent). It is observed that institutional credit agencies, as well as non-institutional credit sources, readily extend credit to the farmers who have more repayment capacity or risk bearing ability which is generally accessed by the ownership of land.

The agencies provide credit to these farmers as there is lesser risk of credit turning into bad debt. From farmer's point of view, the farmers want to avail more credit from institutional credit agencies as they provide loans on lesser rate of interest. In case of non-institutional credit, maximum share was of marginal farmers (71.16 percent) followed by small (56.85 percent), semi-medium (38.79 percent) and medium (25.55 percent) farm size and minimum share was of large farm size with 9.99 percent share. It may be concluded from the above findings that institutional sources are not serving credit for the investment requirements of the marginal and small farmers.

Problems Faced by Farmers in Availing Credit

An attempt has been made to identify different problems faced by the farmer in availing credit. Interestingly, most of the farmers were satisfied by the working of the credit agencies as they had no major problem in the credit process. Still significant number of farmers discussed the problem faced by them. Various problems faced by farmers in availing credit from institutional and non-institutional credit agencies in Punjab have been discussed in Table 5. Major problem

Table 3. Magnitude of institutional and non-institutional credit in borrowed funds, 2015-16

(₹)

Source of credit	Farm size categories					Overall (N=150)
	Marginal (n_1=23)	Small (n_2=28)	Semi-medium (n_3=46)	Medium (n_4=43)	Large (n_4=10)	
Per farm						
Institutional	43696	103143	228804	368256	676000	247420
Non- institutional	107826	135893	145000	126395	75000	127600
Borrowed funds	**151522**	**239036**	**373804**	**494651**	**751000**	**375020**
Per ha						
Institutional	51407	61395	71279	51504	43445	54860
Non- institutional	126854	80889	45171	17678	4820	28293
Borrowed funds	**178261**	**142283**	**116450**	**69182**	**48265**	**83153**

Table 4. Share of institutional and non-institutional credit in borrowed funds, 2015-16

(Percent share)

Source of credit	Farm size categories					Overall (N=150)
	Marginal (n_1=23)	Small (n_2=28)	Semi-medium (n_3=46)	Medium (n_4=43)	Large (n_4=10)	
Institutional	28.84	43.15	61.21	74.45	90.01	65.98
Non- institutional	71.16	56.85	38.79	25.55	9.99	34.02
Borrowed funds	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

faced by farmers for availing institutional credit was non-cooperative attitude of staff of revenue department as 48.67 percent farmers reported it as problem faced in credit processing.

It was found that getting papers from the department was tedious and time-consuming process and officials were involved in corrupt practices which caused hardship to respondent farmers. Other problems reported were offering security (44.00 percent), rigid repayment plan (40.00 percent), inadequate amount (38.67 percent), poor consultation services (32.67 percent), high rate of interest (30.00 percent), slow processing of loans (22.67 percent), favoritism (14.67 percent) and high cost of processing loans (12.00 percent).

In case of problems related to non-institutional sources, farmers reported high rate of interest as major problem with 56.67 percent farmers reporting this problem. Other problems were offering security (44.67 percent) and inadequate amount (28.00 percent). The marginal farmers reported offering security as the major problem in case of institutional sources as 52.17 percent farmers had consent that it was hurdle in availing credit from institutional sources. It was followed by rigid repayment plan (43.48 percent), poor consultation (39.13 percent), non-cooperative attitude of staff of revenue department (39.13 percent), inadequate amount (34.78 percent) and high rate of interest (26.09 percent). In the case of non-institutional sources, high rate of interest was the major problem reported by marginal farmers as 73.91 percent farmers have mentioned it followed by offering security (65.22 percent) and inadequate amount (43.48 percent). On the other hand, the large farmers reported non-cooperative attitude of staff of revenue department (50.00 percent) and poor consultation services (50.00 percent) as major problems in case of institutional credit sources and high rate of interest (56.67 percent) as major problem in case of non-institutional credit sources.

Reasons for Availing Credit from Non-institutional Credit Sources

Non-institutional credit sources play an important role in fulfilling the credit needs of the farmers. The Table 6 divulged the reasons for availing credit from non-institutional credit sources. It was important to notice that share of non-institutional credit in present study came out to be 34.02 percent. Time and again, many researchers have mentioned the importance of non-institutional credit agencies in the working of agriculture sector in the country due to its extensive reach in the agriculture sector. So, reasons for wide prevalent non-institutional system of credit were worked out from the review of literature. There was no need of excessive paperwork and credit was easily accessible to the farmers having personal relationships as well as old accounts with the non-institutional credit agency. Also, emergency credit requirements of the farmers were fulfilled without delay, that is, timeliness. Secrecy and flexible repayment plan were another reasons working in favour of non-institutional credit agencies. All these reasons were presented to farmers and when asked to respond on these reasons, the major reason came out was no paperwork as 68.67 percent farmers responded that it was one of the reason for availing credit from non-institutional sources.

Other important reasons for availing credit were secrecy (64.67 percent), easy access (53.33 percent), and

Table 5. Problems faced by sampled farmers in availing credit by sampled farmers in Punjab, 2015-16

(Percent farmers out of respective sample size)

Particulars	Farm size categories					Overall (N=150)
	Marginal (n_1=23)	Small (n_2=28)	Semi-medium (n_3=46)	Medium (n_4=43)	Large (n_4=10)	
Institutional credit agencies						
Non-cooperative attitude of staff of	39.13	46.43	47.83	55.81	50.00	48.67
Offering security	52.17	57.14	41.30	37.21	30.00	44.00
Rigid repayment plan	43.48	46.43	39.13	39.53	20.00	40.00
Inadequate amount	34.78	35.71	39.13	46.51	20.00	38.67
Poor consultation services	39.13	39.29	23.91	30.23	50.00	32.67
High rate of interest	26.09	46.43	30.43	25.58	10.00	30.00
Slow processing of loans	13.04	25.00	21.74	27.91	20.00	22.67
Favouritism	21.74	21.43	13.04	6.98	20.00	14.67
High cost of processing loans	4.35	7.14	8.70	18.60	30.00	12.00
Non-institutional credit agencies						
High rate of interest	73.91	60.71	54.35	51.16	40.00	56.67
Offering security	65.22	60.71	41.30	34.88	10.00	44.67
Inadequate amount	43.48	32.14	28.26	23.26	-	28.00

Percent exceeds 100 due to multiple response.

Table 6. Reasons for availing credit from non-institutional sources, 2015-16

(Percent farmers out of respective sample size)

Particulars	Farm size categories					Overall (N=150)
	Marginal (n_1=23)	Small (n_2=28)	Semi-medium (n_3=46)	Medium (n_4=43)	Large (n_4=10)	
No paper work	73.91	71.43	67.39	65.12	70.00	68.67
Secrecy	69.57	71.43	65.22	58.14	60.00	64.67
Easy access	78.26	67.86	41.30	44.19	50.00	53.33
Timeliness	60.87	53.57	39.13	32.56	10.00	41.33
Emergency requirements	47.83	46.43	28.26	16.28	10.00	30.00
Flexible repayment schedule	30.43	39.29	26.09	18.60	-	25.33
Old accounts	26.09	14.29	4.35	-	20.00	9.33
Personal relations	8.70	-	6.52	-	10.00	4.00

Percent exceeds 100 due to multiple responses.

timeliness (41.33 percent). Few other reasons like emergency requirements, flexible repayment schedule, old accounts and personal relations were also cited by 30.00, 25.33, 9.33 and 4.00 percent farmers respectively. In case of large farmers, no paperwork was cited as major reason of taking non-institutional loan (70.00 percent) followed by secrecy (60.00 percent) and easy access (50.00 percent). In the case of marginal, easy access (78.26 percent), no paperwork (73.91 percent), secrecy (69.57 percent), timeliness (60.87 percent), emergency requirements (47.83 percent), flexible repayment (30.43percent) and old accounts (26.09 percent) were the main reasons.

CONCLUSIONS

There was significant share of credit in total investment (43.19 percent) made by the farmers. The investment credit taken by the respondent farmers per farm declined with increase in the farm size in relative terms. Also, in total amount borrowed, the share of institutional credit agencies increased with increase in farm size and share of non-institutional credit agencies decreased with increase in farm size. Institutional sources were the main source of credit with 65.98 percent share in total amount borrowed for investment purposes and non-institutional sources had 34.02 percent share. Major problems faced by the respondent farmers in availing credit were non-cooperative attitude of staff of revenue department (48.67 percent) followed by offering security (44.00 percent), rigid repayment plan (40.00 percent), inadequate amount (38.67 percent), poor consultation services (32.67 percent), high rate of interest (30.00 percent), etc. In case of non-institutional sources high rate of interest (56.67 percent), offering security (44.67 percent) and inadequate amount (28.00 percent) were quoted as the major problems. Major reasons for availing loans from non- institutional sources was no paperwork (68.67 percent) followed by secrecy (64.67 percent), easy access (53.33 percent), timeliness (41.33 percent), emergency requirements (30.00 percent), flexible repayment schedule (25.33 percent), etc. There is significant share of non-institutional credit in investment credit. Non-institutional credit agencies play important role in farm business activities. Their working should be regularised so that government can keep check on their working.

REFERENCES

Dhawan, B.D., & Yadav, S.S. (1995). Private fixed capital formation in agriculture: Some aspects of Indian farmer's investment behaviour. *Economic and Political Weekly.30,* Al03-A107.

Directorate of Economics and Statistics. (2016). *State of Indian agriculture 2015-16.* Government of India, Ministry of Agriculture, Cooperation and Farmers Welfare, Directorate of Economics and Statistics, New Delhi.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 366-370
DOI: 10.5958/2322-0430.2018.00121.X

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Economics of Goat Rearing in Ahmednagar District

P.P. Pawar[1], S.M. Garje[2] and D.B. Yadav[3]*

[1]Assistant Professor, College of Agriculture Nandurbar, [3]Head, Department of Agricultural Economics M.P.K.V., Rahuri, and [2]Assistant Manager, Bank of Maharashtra

[*]Corresponding author's email: pawar1964@rediffmail.com

Received: November 06, 2017 *Manuscript Number: NS-18-11* *Revision Accepted: January 18, 2018*

ABSTRACT

The economics of goat rearing study was based on primary data collected from 120 sample flock ownersof flock size viz., small (< 10), medium (10-20) and large (>20) by survey method for the year 2012-13.The average fixed capital investment was ₹91998.64 per flock (58.44 percent) followed by the value of byre (38.30 percent), at the overall level. The total labour used for grazing of goat and maintenance of kids and byre estimated to be90.25and 9.75 percent, respectively. The cost of maintenance was₹5090.86per goat and annual returns ₹7297.58, at the overall.

Keywords

Annual returns, break-even point, cost of maintenance, Goat rearing.

JEL Codes

Q12, Q13, R11.

INTRODUCTION

India has the largest goat population in the world of which 124.36 million goats are breedable. In India, out of the popular 20 breeds of goats, Jamunapari and Barbariis the important milch breeds. The average milk yield per lactation is 30 to 60 litters in the case of indigenous goat and 360 litres from crossbreed goat. Capital investment and feeding costs are also quite low. Four goats can be maintained as cheaply as one indigenous cow(Gupta *et al*., 2011). Goats can be successfully reared in areas where fodder resources are limited and milch cattle do not thrive(Singh *et al*., 2008). The returns on capital of up to 50 percent and recovery of 70 percent of retail price are possible in goat farming. In rural areas, goat farming plays a vital role in providing gainful employment (Behru *et al*., 2009).

Maharashtra possesses 10.68 millions goats of which 91.2 lacks are in Ahmednagar district alone contribute 8.3 percent of the total population in the state among the districts followed by viz., Solapur (7.7 percent), Nashik (5.8 percent), Pune (4.8percent), Yeotmal (4.3 percent), Jalgaon (4.0percent), Sangali (3.6 percent) and Beed (3.5percent). Sangamneri is an important breed of goat found in Ahmednagar, Nashik,and part of Pune. The Highest Sangmneri goat population in Ahmednagar district 52.05 percent of Maharashtra and the highest population of Osmanabadi goat in Osmanabad district 11.77 percent, followed by Latur 8.00 percent and Beed 4.1 percentetc

Goat creates employment for the rural poor besides, effectively utilizing unpaid family labour. Another important aspect of goat rearing is that the goat under the proper condition of upkeep kids three times in two years and twinning is very common (Gawande *et al*., 2008). There is ample scope for establishing cottage industries based on goat meat and value addition to skin and fibre. In view, this is an attempt to study the goat rearing/maintenance costs and returns in Ahmednagar district of Maharashtra.

METHODOLOGY

The Shrirampur and Sangamnertahsil from Ahmednagar district of the Maharashtra state were selected on the basis of the maximum goat population in the district. The sample of 120 goat rearing households which comprised of three size classes Small size: Less than 10 goats per household, Medium size: 10-20 goats per household and Large size: Above 20 goats per household were selected. Four villages from each tahsil

and 15 goats rearer households from each village withtwo stages random sampling technique was employed for selection of goat farmers. The survey method was used for the collection of primary data, with the help of schedule designed for the purpose.

RESULT AND DISCUSSION

Cost of Maintenance of Goat

The data on the average total cost of goat rearing per flock and per goat in different size groups are worked out presented in Table 1 and 2.

The maintenance cost of goat includes expenses on grazing, fodder, labour, veterinary aids, depreciation of byre and equipment, interest on working and fixed capital, losses due to death of goat and miscellaneous charges. It can be seen from Table 1 that per flock cost of goat rearing was ₹77016.55 at the overall level per annum. It is quite obvious that per flock total cost of goat rearing increased with an increase in flock size. Per flock average total cost of maintenance of goat was ₹46820.15, ₹72425.05 and ₹111804.46 in respect of small, medium and large group of flocks, respectively of the total cost of maintenance of goat at the overall level, the working cost includes the grazing and fodder charges, labour charges, veterinary aids, Electricity charge, miscellaneous charges and interest on working capital shared 77.70percent while the fixed cost such as interest on fixed capital, depreciation on byre and equipment accounted for 22.30 percent. The proportion of working cost to the total cost of maintenance is higher in medium size flocks and lower in small size flocks. While that of fixed capital is lower in medium size flocks and higher in small size flocks.

It is important to point out that the expenses on labour grazing and fodder were the major items of working cost. While the interest on fixed capital and depreciation on byre and equipment were the important items of fixed cost in goat rearing. It is noted that on an average the expenses on labour alone share 75.22percent of total working cost while the share of grazing and fodders in the working cost came to 8.65 percent similarly, the share of depreciation on goat, depreciation on byre, depreciation on equipment

Table 1. Costof maintenances of goat

(₹per flocks)

Sr. No.	Particulars	Small	Medium	Large	Overall
1	Dry fodder	520.00 (1.11)	817.20 (1.12)	927.54 (0.82)	754.91 (0.98)
2	Green fodder	611.61 (1.30)	1173.64 (1.62)	1658.47 (1.48)	1147.91 (1.49)
3	Concentrate	3314.40 (7.07)	6265.64 (8.65)	10589.60 (9.47)	6723.21 (8.72)
4	Human labour	27530.00 (58.79)	38944.00 (57.77)	60755.54 (54.34)	42409.85 (55.06)
5	Medicine	407.14 (0.86)	751.29 (1.03)	1544.95 (1.38)	901.13 (1.17)
6	Electricity charge	103.25 (0.22)	187.50 (0.25)	390.61 (0.34)	227.12 (0.29)
7	Miscellaneous expenditure	347.04 (0.74)	664.78 (0.91)	1367.08 (1.22)	792.97 (1.02)
8	Interest on working capital (13 percent)	4268.34 (9.11)	6344.46 (8.75)	10040.32 (8.98)	6884.37 (8.93)
9	Variable Cost (1 to 8)	37101.78 (79.24)	55168.05 (76.17)	87273.57 (78.05)	59847.80 (77.70)
10	Depreciation on goat (12.5 percent)	2987.75 (6.38)	5696.93 (7.86)	11732.87 (10.49)	6805.85 (8.83)
11	Depreciation on shed (10 percent)	1754.25 (3.74)	2882.94 (3.98)	5654.92 (5.05)	3430.70 (4.45)
12	Depreciation on equipment (10 percent)	198.78 (0.42)	244.10 (0.33)	284.60 (0.25)	242.49 (0.31)
13	Interest on fixed capital (11 percent)	4777.45 (10.20)	8453.05 (11.67)	16858.50 (15.07)	10029.67 (13.02)
14	Fixed Cost (10 to 13)	9718.33 (20.75)	17277.02 (23.85)	24530.89 (21.94)	17175.41 (22.30)
	Total Cost (9 to 14)	46820.15 (100.00)	72425.05 (100.000	111804.46 (100.00)	77016.55 (100.00)

Figures in parentheses indicate percentage of the total.

and interest on fixed capital cost in the fixed cost at the overall level was 8.25, 4.24, 0.34 and 11.94 percent, respectively.

The picture of the average cost of maintenance of goat would be clearer if we examine data on per goat basis contained in Table 4. It is noted that per goat average total cost of maintenance per annum come to ₹6429.41, ₹5055.22, and ₹3787.96 in the case of asmall, medium and large group of flocks respectively. This was ₹5090.86 at overall level.

Gross Returns from Goat Rearing Return in Physical Units

Gross returns in goat rearing included the income from the sale of goat, manure, and milk. At first, the returns in physical quantities have been assessed for different size group of flocks. The annual returns under these items have been presented in Table 3. It is seen that at an overall level per flock sale of the goat was 22.48goats. The quantity of manure obtained from goat, was 976.73 kg at overall level and while that of milk was 491.47 litres.

The sale of goat per flock, manure and milk showed an increase with an increase in the size of the flock which is quite acceptable. On examination of data on per goat basis, it is seen that average annual production of milk was 38.48 litters. However, the flock wise milk yield varies from 51.5 (small) to 21.61 (large). It was due to higher feeding to kids in view to obtain fast growth. On an average, manure obtained per goat was 0.87 kg per annum and sale of the goat was 1.95 in numbers and per goat quantity of milk is decreased with an increase in the flock size.

Returns in Monetary Terms

The returns from goat rearing have been worked out in monetary terms. It included the value of goat sold, manure and milk. The annual gross returns from the above sources per flock and per goat are presented in Table 4.

It is apparent that annual gross returns from different sources in goat rearing per flock at overall level came to ₹114478.70, of the total gross returns, the sale of goat

Table 2. Per goat cost of maintenances

(₹)

Sr. No.	Particulars	Small	Medium	Large	Overall
1.	Dry fodder	74.26 (1.07)	57.52 (1.13)	32.91 (0.86)	54.90 (1.07)
2.	Green fodder	82.55 (1.19)	39.16 (0.77)	56.44 (1.48)	59.38 (1.16)
3.	Concentrate	456.00 (6.58)	422.00 (8.34)	343.60 (9.07)	407.20 (7.99)
4.	Human labour	3770.00 (54.40)	2748.00 (54.35)	2084.40 (55.02)	2867.47 (56.32)
5.	Medicine	55.00 (0.79)	53.01 (1.04)	53.00 (1.39)	53.67 (1.05)
6.	Electricity charge	13.95 (0.20)	13.22 (0.26)	13.40 (0.35)	13.52 (0.26)
7.	Miscellaneous expenditure	46.89 (0.67)	46.89 (0.92)	46.89 (1.23)	46.89 (0.94)
8.	Intrest on working capital (13percent)	584.84 (8.43)	439.37 (9.75)	297.30 (7.84)	440.50 (8.65)
9.	Variable cost (1 to 8)	5156.82 (80.57)	3895.73 (75.54)	2584.84 (68.24)	3879.13 (75.22)
10.	Depreciation on goat (12.5percent)	419.97 (6.08)	419.97) (8.30)	419.97 (11.08)	419.97 (8.24)
11.	Depreciation on shed (10percent)	253.84 (3.46)	202.38 (4.00)	193.99 (5.12)	216.74 (4.25)
12.	Depreciation on equipment (10percent)	26.40 (0.38)	17.08 (0.33)	9.74 (0.25)	17.74 (0.34)
13.	Interest on fixed capital (11percent)	645.71 (9.33)	596.62 (11.82)	579.42 (15.29)	607.25 (11.94)
14	Fixed cost (10 to 13)	1365.17 (19.43)	1260.50 (24.46)	1203.12 (31.76)	1276.26 (24.78)
15.	Total cost (9 to 14)	6429.41 (100.00)	5055.22 (100.00)	(3787.96 100.00)	5090.86 (100.00)

Figures in parentheses indicate percentage of the total.

Table 3. Gross returns in physical units in different size groups of flocks

Particulars	Small	Medium	Large	Overall
Per flock				
Sale of goats (No.)	15.91	29.05	48.08	22.48
Manure (kg)	650	1303.45	2361.27	976.73
Milk (*l*)	381.82	601.12	629.25	491.47
Per goat				
Sale of goats (No.)	2.15	2.05	1.65	1.95
Manure (kg)	0.87	0.82	0.81	0.83
Milk (*l*)	51.5	42.33	21.61	38.48

Table 4. Source wise annual income per flock

(₹)

Items	Small	Medium	Large	Overall
Sale of goat	51389.3	93831.50	154849.8	100023.5
Manure	1448.55	2614.50	5312.25	3125.10
Milk	8003.10	12758.55	13228.53	11330.06
Gross return	60840.9	109204.5	173390.5	114478.66
Per goat				
Sale of goat	6944.50	6621.50	5329.50	6298.50
Manure	195.75	184.50	182.25	187.50
Milk	1081.50	899.43	453.81	811.58
Gross return	8221.75	7705.43	5965.56	7297.58

Figures in parentheses indicate percentage to the total.

shared 87.38 percent, while that of milk shared 9.89 percent. This indicates that sale of goat and milk were the major sources of income in goat rearing. The next an important source of income was manure 2.73 percent. The gross returns from different sources were ₹60840.95, ₹109204.55 and ₹173390.58 in the case of small, medium and large size group of goat, respectively. On examination of proportions of income from different sources amongst the size classes, it is observed that the percentage of income received from the sale of the goat was highest in small size class, and in the case of milk income received was highest in large size class. However, in the case of other sources of income, there were no much variations in proportions of income received among different size classes of goat flocks.

It may give better view if we examine the sources wise average annual income per goat in different size of classes of flocks presented in Table 5. The gross returns from different sources, at an overall level, were ₹7297.58per goat. Per goat gross return were ₹8221.75, ₹7705.43 and ₹5965.56 in the case of small, medium and large size classes of flocks, respectively indicating that per goat gross returns were maximum in the case of small size group. As indicated earlier, the sale of goat and income due to milk were major sources of income in goat rearing. The receipts due to the sale of goat and milk were highest for the large size of flocks. The results were conformity with the result obtained by Prabaharan & Thirunavakkarasu (1995) with net income.

Flock Efficiency Measures

The profitability in goat rearing was worked out by estimating the returns both at working cost and total costs. The relevant data in this regard presented in Table 5. It is noted that per flocks net returns over working cost were ₹23739.17,₹54056.5 and ₹86117.01 in the cases of small, medium and large size classes of goat with an overall of per goat 54637.56.

Importantly, net profit over total cost were ₹14020.84,₹36779.48 and ₹61586.58 in the cases of small, medium and large size classes of goat respectively, with an overall average of ₹37462.30. On examination of per goat net returns over working costs, were ₹3138.26, ₹3886.26 and ₹3380.72 in the cases of small, medium and large size classes of goat respectively, with an overall average of

Table 5. Gross and net profit from goat rearing in different size flocks

(₹)

Particulars	Farm Category			
	Small	Medium	Large	Overall
Per Folck				
Gross returns	60840.95	1099204.55	173390.58	114478.7
Working cost	37101.78	55148.05	87273.57	59841.13
Fixed cost	9718.33	17277.02	24530.89	17175.41
Total cost	46820.11	72425.07	111804.00	77016.39
Operating income	23739.17	54056.5	86117.01	54637.56
Net profit	14020.84	36779.48	61586.58	37462.30
Per Goat				
Gross returns	8221.75	7705.43	5965.56	7297.58
Working cost	5083.49	3819.17	2584.84	3829.17
Fixed cost	1345.92	1236.05	1203.00	1261.66
Total cost	6429.41	5055.22	3787.96	5090.86
Operating income	3138.26	3886.26	3380.72	3468.62
Net profit	1792.34	2650.21	2631.43	2206.72

Table 6. Output-input ratio in goat rearing in different size groups of flocks

Particulars	Small	Medium	Large	Overall
Per flocks				
Working cost	1.63	1.98	1.98	1.91
Total cost	1.29	1.50	1.55	1.48
Per goat				
Working cost	1.61	2.01	2.30	1.90
Total cost	1.27	1.52	1.57	1.43

₹3468.62. However, per goat net profits over total cost were₹1792.34,₹2650.21,and₹2631.43in the case of small, medium and large size classes of flocks. It is observed that the goat maintenance cost was quite higher because of relative more expenses towards labour, concentrate and fodder charges in the small size flocks which were the reason for getting minimum returns over total cost.

Output-input Ratio

The efficiency of operating the goat enterprise has been examined by comparing the output-input ratios in different size groups of flocks. The ratios are given in Table 6. At the overall level, the output-input ratio was 1.91 and 1.48 at the working and total cost, respectively. The output-input ratio at working cost was 1.63, 1.98 and 1.98 in the case of small, medium and large size classes of flocks, respectively. This ratio at the total cost, however, was 1.29,1.50 and 1.55 in the small, medium and large size classes of goat, respectively. The output-input ratio has less in small size flocks and higher in large size flocks.

CONCLUSIONS

Fixed capital investment per goat was observed to be ₹5512.65. The flock stock (55.04 percent) was the major item of fixed capital investment in goat rearing. The activity of goat rearing was observed to begain ful enterprise. At the overall level, per goat cost of maintenance worked out to ₹5090.86 and gross return per goat per annum came to ₹7297.58. The net returns per goat per annum, therefore, came to ₹2206.72. The break-even point of small, medium and large size of flocks came to 7, 14 and 29 goat, respectively where there would be neither loss nor profit in goat rearing. The regression analysis indicated that the factors viz., flock size, labour, fodder charges and concentrate together explained 79 to 84 percent of the variation in the gross returns from goat rearing. The role of flock size and concentrate in goat rearing was observed to be significant on the annual gross returns. A large number of problems were faced by goat rearers of which, non-availability of grazing land, shortage of green fodder and dry fodder, marketing of young stock, milk marketing, and veterinary clinic were the major problems in goat rearing. In order to improve the goat rearing, the goat rearers suggested the development of village grazing lands, the supply of adequate fodder, the establishment of co-operative marketing societies, credit facilities, transfer of stall feeding technology and necessity of veterinary services, which needs to be given thought by the policymakers.

Policy Implications

There is a need to develop grazing lands or pastures on the public lands which could be subsequently made available to the goat rearers on rent basis. This is because inadequacy of grazing lands is a severe problem in goat rearing. Adequate infrastructure may be strengthened for providing dependable health cover against common diseases of goat, technical know-how to goat rearers for better care and management of their flock, supply of bucks and doe of superior breeds, etc. in order to develop this enterprise in the scarcity area of the state. The landless agricultural labourer, small and marginal farmers may be given incentives for maintaining goat activity as a supplementary enterprise by providing then with aloan at a minimum rate of interest. This will help them to generate additional source of income and employment from their own activity.

REFERENCES

Behura, N.C., Panda O.S., Mishra O.S., & Dehuri P.K. (2009). The contribution of small ruminants to sustainable livelihood of villagers in Koraput district of Orissa. *Indian Journal of Small Ruminant, 15*(1), 62-67.

FAOSTAT. (2008). Retrieved from http://faostat.fao.org/default.aspx

Gawande, S.H., Shaikh A.A., Nikam T.R., & Hatey A.A. (2008). Personal and socioeconomic attributes of goat keepers. *Indian Journal of Animal Science, 49*(3), 285-289.

Gupta, D.C., Suresh A., & Sethi D. (2011). Economics of sheep and goat rearing in semi-aridregion of Rajasthan. *Indian Journal of Small Ruminants, 17*(2), 215-221.

Prabaharan, R., & Thirunavukkarasu, M. (1995). Goat husbandry in Tamil Nadu (India). An economic appraisal. *Indian Journal of Animal Production and Management 11*(6), 14-26.

Singh, A.K., Rai B., Singh Palfarvi, Singh P., & Singh N.P. (2008). Goat production status in different agro-climatic regions of India: An overview. *Indian Journal Small Ruminants,14*(1), 48-70.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 371-376
DOI: 10.5958/2322-0430.2018.00083.5

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Comparative Economic of Cross-bred cow *versus* Pandharpuri Buffalo Milk Production in Western Maharashtra

R.B. Hile, D.J. Sanap and D.B. Yadav*

Department of Agricultural Economics, MPKV, Rahuri-413722

**Corresponding author's email: rbhile@gmail.com*

Received: November 14, 2017 *Manuscript Number: NS-18-13* *Revision Accepted: January 25, 2018*

ABSTRACT

The study was conducted in Satara and Solapur districts of Western Maharashtra. The present investigation was carried out to know the costs and returns, marketing of milk of cross-bred cow and pandharpuri buffalo in Western Maharashtra. The results revealed that the per year maintenance cost of the cross-bred cow was higher (₹57,339) than pandharpuri buffaloes (₹51,394). Per year returns from cross-bred cow milk production were highest (₹95106.41) than pandharpuri buffaloes (₹71423.31) milk production and the total benefit cost ratio were also more in case of across-bred cow (1.84) as compared to that of pandharpuri buffaloes (1.39). The results of production function analysis in cross-bred cow and pandharpuri buffalo milk production of dry fodder, green fodder and concentrates were highly significant indicating an increase in the input will increase the milk production. Per liter marketing cost of milk was higher in pandharpuri buffalo milk (38.02₹/l) as compared to cross-bred cow milk(21.40₹/l) due to high-fat percentages, quality of ghee and demand of buffalo milk. However, the milk production of across-bred cow (1240.22 l) and pandharpuri buffalo (986 l) was higher than the break-even point. The maximum quantity of milk of cross-bred cow and pandharpuri buffaloes was sold through Channel-III (producer to the private dairy unit) and the producer in consumers rupees was highest in Channel-I (96.05percent) and 91.95percent) of cross-bred cow and pandharpuri buffalo milk, due to the absence of involvement of market functionaries. The milk production and marketed surplus of milk were found higher of the cross-bred cow as compared to pandharpuri buffalo. The study revealed that the farmers should get the remunerative price to cross-bred cows and pandharpuri buffaloes milk production in the study area. The dairy enterprises were increases in employment, income and improve the standard of living of farmers.

Keywords
Break even, comparative economic, marketing channel, marketed surplus, price spread.

JEL Codes
C83, M31,O13, O16, P51, Q12, Q13.

INTRODUCTION

Dairy enterprise improves the welfare by providing income and employment to the farm households. The dairy industry has played an important role to improve the economy of small milk producer's farmers in the different state of India. Maharashtra is one amongst them, which is predominantly an agricultural state with an excellent potential for milk production. The dairy industry has not only provided an organized network of milk marketing to the rural area but also provide the crucial technical inputs like provision of artificial insemination, health services, and feed inputs. Milk provides a highly nutritious food for people of all age groups and particularly for infants and lactating mothers, thus reducing the problem of malnutrition among rural households. The value adding activities such as the processing, marketing, and distribution of milk and milk products create employment opportunities in the society.

A cost plays an important role in the economic viability of a dairy enterprise. It is a critical economic indicator for milk producers, policymakers,and consumers for fixing the price of milk rationally. Generally, milk producer can increase the milk production or by reducing the milk production. Cost of milk production often becomes a policy issue, when milk producers complain that the price of milk they are getting does not cover the cost of milk production. A large number of Cross-bred cows and pandharpuri buffaloes are being

reared in Satara and Solapur district, and the milk production is the main subsidiary enterprise of the farmers in districts. Hence, keeping the above background in mind, it was felt necessary to study the comparative economics of cross-breed cows *Vs* pandharpuri buffaloes milk production.

METHODOLOGY

Satara and Solapur districts were purposively selected because it is well known for higher milk production of cross-bred cow and pandharpuri buffaloes in the western Maharashtra region. Two tahsils from each district *viz;* Satara and Koregaon from Satara district and Malshiras and Pandharpur from Solapur district were selected as the cross-bred cows and pandharpuri buffaloes were more concentrated in these tahsils. From each tahsil, three villages were selected randomly. Thus, in all 12 villages from the four tahsils were selected. From each village, 20 farmers were selected randomly. Thus, 120 farmers for cross-bred cow and 120 farmers for Pandharpuri buffaloes were selected for the study**.** The primary data were collected for the year 2014-2015.

Estimation of Per Farm Expenditure on Dairy Enterprise

$$C = \sum ci \,.xi$$

Where,

C = Per farm expenditure on dairy enterprise

ci = Total cost of maintenance of ith milch animal

xi = Number of milch animals of ith category

Estimation of Per Farm Income from Dairy Enterpris

$$Y = \sum yi \,.xi$$

Where,

Y = per farm income from dairy enterprise

yi = Total income per animals of ith category

xi = Number of milch animals of ith category

Production function analysis

The Cobb-Douglas type production function was used for estimating the resource use productivities.

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7} e^u$$

Where,

Y	:	Total milk production (litres)
X_1	:	Number of milch animal
X_2	:	Green fodder (kg)
X_3	:	Dry fodder (kg)
X_4	:	Concentrates (kg)
X_5	:	Total labour (days)
X_6	:	Veterinary aids (₹)
X_7	:	Total maintenance cost (₹)
a	:	Constant
u	:	Error term
bi's	:	Production elasticities/regression coefficient

Break-even Output

Break-even point level of milk production was worked out as per Parmar *et al*. (2010) with the help of following formula

$$\text{Break-even output} = \frac{\text{Total fixed cost per animal}}{\text{(Price/liter of milk – Variable cost /liter of milk)}}$$

Price spread

It refers to the difference between price paid by the consumer and price received by the milk producer for an equivalent quantity of the milk.

Producers share in consumer's rupee

It is the ratio of net price received by milk producer to the price paid by consumer and calculated as:

$$\text{Producer share in Consumer rupee} = \frac{\text{Net price received by milk producer}}{\text{Price paid by consumer}} \times 100$$

RESULTS AND DISCUSSION

Comparison of Maintenance Cost of Cross-bred Cow and Pandharpuri Buffalo

It is revealed from Table 1, the total maintenance cost of cross-bred cow was (₹57338.70) found to be more than that of pandharpuri buffalo (₹51394), while per liter maintenance cost pandharpuri buffalo (₹30.98) was higher than that of cross-bred cow (₹11.64) due to less amount of dry fodder and labour charges led to low maintenance cost for cross-bred cow. It is nearly 2.6 times more than the cost for pandharpuri buffalo as compared with across-bred cow. Further, the average net maintenance cost per day per milk for cross-bred cow and pandharpuri buffalo was found to relatively more in the year, which might be attributed to the higher price of feed and fodders. Similar findings were obtained by Bairwa *et al.* (2016); Singh & Datta (2016).

Costs and Returns Structure of Cross-bred cow and Pandharpuri Buffalo Milk Production

The perusal of Table 2 revealed that the annual gross returns from milk production for cross-bred cow were found to be higher (₹95,106.41) as compared pandharpuri buffalo (₹59,291.40). However, total returns from the cross-bred cow were more than ₹34241.99 pandharpuri buffalo milk production. It was mainly due to the low returns from the sale of offspring in Pandharpuri buffalos. The total benefit-cost ratio was also more in case of a crossbred cow (1.84) as compared to that of buffalo (1.39), which indicated that by investing ₹1 in cross-bred cow and pandharpuri buffalo milk production, net returns of ₹0.84 and ₹0.39 were earned by sample farmers. Hence, the cross-bred cow was more profitable than pandharpuri buffalo. These results were in conformity with the study of Babar *et al.* (2010); Parmar *et al.* (2010); Kaur & Kaur (2013).

It is concluded that the profitability can be increased by increasing the per cross-bred cow and pandharpuri buffalo milk production by way of efficient management and maintenance. Because, the average per day per cross-bred cow and pandharpuri buffalos milk production only ranges from 7-8 and 4 - 6 liters per day, respectively.

Table 1. Maintenance cost of Cross-bred cow and pandhapuri buffalo

(₹/year)

Items	Crossbred cow		Pandharpuri Buffalo	
Variable cost	**Qty. (kg)**	**₹**	**Qty. (kg)**	**₹**
a) Dry Fodder	2761.82	6573.14 (11.47)	2701.99	6754.98 (13.14)
b) Green Fodder	7024.39	19387.34 (33.81)	5458.98	15918.83 (30.97)
c) Concentrate	691.33	10370.09 (18.09)	439.95	6435.20 (12.52)
d) Labour Charges		5478.49 (9.55)		7473.33 (14.54)
e) Veterinary .expenses		632.75 (1.10)		587.56 (1.14
f) Miscellaneous		286.99 (0.50)		290.27 (0.56)
Total Variable cost		42728.80 (74.52)		37460.16 (72.89)
Fixed cost		Overall		
a) Depreciation on Animal, Byre, Utensils		7132.93 (12.44)		6655.55 (12.95)
Interest on fixed capital		7476.97 (13.04)		7278.28 (14.16)
Total fixed cost		14609.90 (25.48)		13933.83 (27.11)
Total maintenance cost		57338.70 (100)		51394.00 (100)
Value of dung (₹)		5606.60		3034.63
Net maintenance cost (₹)		51732.10 (90.22)		48359.37 (94.09)
Per liter maintenance cost (₹)		11.64		30.98

Figures in parentheses indicate percentage of the total.

Table 2. Cost and returns structure of milk production

(₹/year)

Item	Cross-bred	Pandharpuri buffalo milk
Milk	95106.41 (90.01)	59291.40 (83.03)
Milk (l)	4444.22	1561.11
Rate (/lit.)	21.40	38.02
Dung	5606.60 (5.30)	3034.63 (4.24)
Offspring sale	4952.29 (4.69)	9097.29 (12.73)
Total returns	105665.30 (100)	71423.31 (100)
Total maintenance cost	57338.70	51394.00
Net returns	35262.13	20029.32
B:C Ratio	1.84	1.39

Comparison of Disposal of Cross-bred cow and Pandharpuri Buffalo Milk

Table 3 depicted that, the marketed surplus of pandharpuri buffalo was comparatively less (82.49 percent) than that of across-bred cow (96.12 percent). The use of milk for family consumption of pandharpuri buffalo was found to be higher (17.51 percent) than cross-bred cow milk (3.88 percent). However, the rate of milk received rupees per liter for pandharpuri buffalo was highest (₹38.02/*l*) than cross-bred cow milk (₹21.40/*l*) due to high-fat percentages, quality of ghee and demand of milk. The per farm disposal of cross-bred cow milk was higher than the pandharpuri buffalo milk. Similar findings confirmed by Rao *et al. (*2004); Kumar *et al.* (2016).

Comparison of Cobb-Douglas Production Function of Cross-bred Cow and Pandhapuri Buffalo

It is seen from Table 4, in case of cross-bred cow and pandhapuri buffalos no. of milch animal (X_1), green fodder (X_2), dry fodder (X_3), concentrates (X_4), labour (X_5) and veterinary aids (X_6) were positively and significantly. This indicates that there is scope to increase

the use of these resources to increase the milk production. The variables of green fodder, dry fodder and concentrate were highly significant. It indicates that there is scope for feeding cow and buffalo with green fodder, dry fodder and concentrates in order to increase the milk production. Similar results were reported by Kashish *et al.* (2016).

Break-even Point Analysis of Cross-bred Cow and Buffalo Milk Production

Break-even level of milk production is that point of production where the farmers neither gains profit nor incuse loss. Table 5, shows the result of the break-even point analysis for the cross-bred cow which was higher than that of Pandharpuri buffalo milk production. It was clearly noted that the actual quantity of milk production was higher than that of the quantity of milk required for fulfilling the break-even point in crossbred cow and Pandharpuri buffalo milk producing farmers. It indicates that the milk production activity was a profitable venture. However, the farmer can increase the profit more and more as the milk production of crossbred cow and Pandharpuri Buffalos increased over the present milk production. Similar findings were reported by Parmar *et al*. (2010)

Channel-wise Marketing of Milk of Cross-bred Cow and Pandharpuri Milk

From the Table 5, the cow and buffalo milk producer farmers were preferred10 to 16 percent of Channel-Ias milk marketing. It might be due to the fulfillment of the daily needs of farmers. Amongst, the Channel-II and IV were preferred only 4 to 8 and 5 to 21 percent. However, the majority of the farmers preferred Channel-III (Producer-Private dairy units) even though the rate obtained was less than other three channels. This situation was mainly due to the low local demand and farmers get paid every month regularly from the private dairy units.

Table 3. Disposal of Cross-bred cow and pandharpuri buffalo milk

(*l*)

Particulars	Crossbred cow milk (liter)	Pandharpuri buffalo milk (liter)
Total milk production	4444.22 (100)	1561.11 (100.00)
Family consumption	172.43 (3.88)	273.32 (17.51)
Marketed	4271.79 (96.12)	1287.79 (82.49)
Rate received (₹/*l*)	21.40	38.02

Figures in parentheses indicate percentage of the total.

Table 4. Results of Cobb-Douglas production function of Cross-bred cow and pandharpuri buffalo milk

Particulars	Cross-bred cow milk	Buffalo milk
Intercept	0.13726	0.8144
No. of milch animal (X_1)	0.0981** (0.04025)	0.3673*** (0.0797)
Green Fodder in kg (X_2)	0.1583*** (0.0509)	0.1789*** (0.0643)
Dry Fodder in kg (X_3)	0.2085*** (0.0486)	0.0134*** (0.0046)
Concentrates in kg (X_4)	0.3403*** (0.0690)	0.1471*** (0.0508)
Labour in days (X_5)	0.1226** (0.0641)	0.2833*** (0.0530)
Veterinary aids in (X_6)	0.1165* (0.0576)	0.2631* (0.1310)
Total Maintenance cost in (X_7)	0.0231 (0.0259)	-0.0063NS (0.0219)
R^2	0.89	0.9547
Degree of freedom	112	112

*'***', '**', and '*' Significant at 1, 5 and 10 percent level, respectively.*
NS: Non-significant.

Table 5. Break-even point of Cross-bred cow and Pandharpuri Buffalo milk

(₹)

Particulars	Crossbred cow milk	Pandharpuri buffalo milk
Total fixed cost per animal	14609.90	13933.83
Price milk (₹/l)	21.40	38.02
Variable cost of milk (₹/l)	9.62	23.90
Break-even point (l)	1240.22	986.81
Actual milk production (l/buffalo/ year)	4444.22	1561.11

Table 6. Channel-wise marketing of milk

(*l*/channel)

Channel /Milk marketing	Cross-bred cow milk	Pandharpuri buffalo milk
Producer - Consumer	479.09 (10.78)	252.59 (16.18)
Producer -Hotels	183.99 (4.14)	130.51 (8.36)
Producer - Private dairy units	2813.19 (63.30)	1095.27 (70.16)
Producer-Cooperative dairy units	967.95 (21.78)	82.66 (5.30)
Total	4444.22	1561.11

Figures in the parentheses indicate percentage of the total.

Table 7. Price spread of Cross-bred cow and pandharpuri buffalo milk marketing

(₹/*l*)

Particulars	Channel							
	Cross-bred cow				Pandharpuri buffalo			
	I	II	III	IV	I	II	III	IV
Producer's sale price	22.50 (100)	21.60 (89.25)	21.4 (62.76)	20.10 (61.56)	38.97 (100)	40.79 (94.01)	37.57 (75.14)	33..50 (73.63)
Marketing cost of producer	1.81 (8.04)	1.32 (5.45)	1.71 (5.01)	1.58 (4.83)	1.54 (3.95)	1.67 (3.85)	0.96 (1.92)	1.10 (2.42)
Net price received by producer	20.69 (91.95)	20.28 (83.80)	19.69 (58.74)	18.52 (56.72)	37.43 (96.05)	39.12 (90.16)	36.61 (73.22)	32.40 (71.21)
Purchase price of middleman	-	21.60	21.40	20.10	-	40.79	37.57	33.50
Marketing cost incurred by middle man	-	1.65	2.50	2.25	-	1.65	2.50	2.30
Marketing margin	-	0.95	1.50	1.30	-	0.95	1.50	1.25
Sale price of middleman	-	-	25.40	23.65	-	-	41.57	37.05
Wholesaler price	-	-	25.40	23.65	-	-	41.57	37.05
Marketing cost incurred by wholesaler	-	-	5.70	5.50	-	-	5.70	5.35
Wholesaler margin	-	-	3.00	3.50	-	-	2.73	3.10
Consumer's price	22.50 (100)	24.2 (100)	34.10 (100)	28.65 (100)	38.97 (100)	43.39 (100)	50.00 (100)	42.50 (100)
Producer's share in consumer's	91.95	83.80	58.74	64.64	96.05	90.16	73.22	76.23

Figures in parentheses are percent of the consumer's price.

Also, sometimes private dairy units provide the feeds or utensils on credit basis to the farmers and deduct from the payment in installments. The similar type of results was reported by Islam *et al*. (2008); Kashish *et al.* (2015); Singh & Singh (2016).

Price spread in Cross-bred cow and Pandharpuri Buffalo Marketing of Milk

The perusal of Table 6 revealed that per liter marketing cost of the producer was more in cross-bred cow milk than pandharpuri buffalos milk. The maximum sale price of cross-bred cow milk came tounder to (₹22.50) Channel-I and buffalos milk sale price came to (₹40.79) under Channel-II, respectively. Channel-I (Producer-Consumer) was found to be more efficient, the producers share in consumer's price was highest in pandharpuri buffalos milk (96.05) as compared crossbred cow milk (91.95percent), due to the absence of involvement of market functionaries. The net price received by the producer of cross-bred cow and pandharpuri buffalo milk was highest in Channel-I and Channel-II. The major marketing channel observed for both the cross-bred cow and pandharpuri buffalos milk was Channel-III (Producer-Private dairy units).In Channel-III, lower producer's share in consumer's price was found due to the involvement of large market functionaries in cow and buffalos milk marketing. However, it was noticed that even though the producer's share in consumer rupee was lowest in Channel-III, the quantity of milk sold through this channel was highest. The highest market margin was observed in Channel-III in both the cross-bred cow and Pandharpuri buffalo milk of marketing. The marketing of milk many farmers mostly preferred Channel-III and IV due to timely payment. A similar type of results has been reported by Bhairwa *et al.* (2016); Kumar *et al.* (2016); Parmar *et al.* (2010).

CONCLUSIONS

1. The cost returns and benefit-cost ratio of crossbred cow milk production were more profitable than pandharpuri buffalo milk production; both dairy enterprise cow and Buffalos milk are profitable enterprises. The major marketing channel observed for both the cross-bred cow and pandharpuri buffalo milk was Channel-III (Producer-Private dairy).
2. The study revealed that crossbred cows were more economical for persuading the dairy farmers to continue crossbred cow rearing to enhance their incomes and gave a higher yield than pandharpuri buffalo. The crossbred cows can increase the income of a dairy entrepreneur and provide gainful the year employment to its family. The findings of the present study would be of practical significance for the researchers, extension workers, policy makers, planners, administrators and dairy farmers, so as take rational decisions for benefit of milk-producing farmers.

REFERENCES

Babar, A.P., Satpute, T.G., & Sanap, D.J. (2010). Comparative economics of milk production of crossbreed cow and buffalo in Parbhani district of Maharashtra. *International*

Research Journal of Agricultural Economics and Statistics, 2(1), 31-34.

Bhairwa, R.L., Chauhan, A.K., Nagrale, B.G., & Franco, D. (2016). Economic analysis of milk production and marketing surplus in Chittorgarh district of Rajasthan. *Indian Journal of Diary Science, 12*(3), 353-358.

Islam, S., Goswami, A., & Mazumdar, D. (2008). Comparative profitability of cross breed and indigenous cattle in West Bengal. *Indian Research Journal of Extension Education, 8*(1), 28.

Kashish, Kaur, M., Sekhon, M.K., & Dhawan, V. (2015). Economic analysis of milk production among smallholder dairy farmers in Panjab: A case study of Amritsar district. *Indian Journal of Economics and Development, 12*(2), 335-340.

Kaur, S., & Kaur, P. (2013). Comparative economics of milk production among different breeds of milch animals in Punjab. *Indian Journal of Economics and Development*, *9*(4), 312-317.

Kumar, M., Dhillon, A., & Luhach, V.P. (2016). Economic analysis of milk marketing and disposal pattern in Haryana. *Indian Journal of Economics and Development, 12*(1a), 57-61.

Parmar, H.C., Zala, Y.C., & Arya, J.S. (2010). Comparative economics of milk production for a buffalo, indigenous and crossbred cow in Vadodara district of Gujarat. *Indian Journal of Dairy Science*, *63* (5), 408-413.

Rao, N., Kumar, P., Pal, G., & Sen, C. (2004). Economics of milk production in district Khanpur (Dehar), Uttar Pradesh. *Indian Journal of Agricultural Economics, 59*(3), 624.

Singh, N., & Singh, J.M. (2016). Milk sale pattern and constraints in dairy farming in thesub-mountainous region of Punjab. *Indian Journal of Economics and Development, 12*(1a), 29-32.

Singh, P., & Datta, K.K. (2016). Economic analysis of traditional milk supply chain in Ranchi district of Jharkhand. *Indian Journal of Economics and Development,12*(3), 495-502.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 377-382
DOI: 10.5958/2322-0430.2018.00084.7

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Economics of Gur Khadsari Enterprise in Punjab-A study of an Agro-based Industry

Pardeep Kaur[1] and Mini Goyal[2]*

[1]Research Scholar and [2]Senior Economist (Marketing), Department of economics and sociology
Punjab Agricultural University, Ludhiana-141004

[*]Corresponding author's email: cheemapardeep00@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-130* *Revision Accepted: March 08, 2018*

ABSTRACT

Agricultural sector can be rightly called upon as the mother and the caretaker of all the major and minor sectors. The rural agro-based industries were the effective means to absorb rural population that was either unemployed or under-employed. To study the socio-economic profile of entrepreneurs engaged in gur khandsari as agro-based village industries and to analyze the economics of gur khandsari enterprise, the study was conducted in Fatehgarh district of Punjab state. From 40 villages falling in the districts, 15 entrepreneurs of gur khandsari enterprise were found. These were categorized into different farm categories according to their agricultural land ownership. The study revealed that all the entrepreneurs were male and their average age was 44.33 year. Average agricultural land ownership of 15 entrepreneurs was 6.83 acres and average limit of credit was 3.39 lakh. Capital investment was highest for entrepreneurs who had small farms (₹293700). Annual net returns were found highest (₹112492) in the case of semi-medium farm entrepreneurs. By investing one rupee on fixed and variable resources of gur khandsari enterprise, earned an amount of ₹1.27 on an average in Punjab as is indicated by the output-capital ratio in gur khandsari. This shows that there were net earnings of rupee 0.18 which came to be 16.69 percent of total earning and remaining 83.31 percent was the total cost on an average of Punjab. Similarly, benefit cost ratio at both variables and fixed costs were 0.27 and 0.18 respectively. The average payback period of gur khandsari enterprise was 2.13 year.

Keywords
Credit, enterprise, entrepreneur, investment, payback.

JEL Codes
H81, L16, L26, L53, P25.

INTRODUCTION

Agriculture plays an important role in Indian economy. About 55 percent of the population is engaged in agriculture and allied activities and it contributes 17.4 percent to India's gross domestic product. As per the First Advance Estimates (AE) by Ministry of Agriculture and Farmers Welfare (2016), the production of *Kharif* food-grain for the period of 2016-17 is predictable at 135.0 million tons as compared to 124.1 million tonnes in 2015-16 (Government of India, 2016). Every year in India, food grains production has increased and the country is among the top producers of pulses, rice, wheat, cotton, and sugarcane. India is the largest producer of milk and second in the production of fruits and vegetables (Deshpande, 2017). The generation of the surplus from agriculture ultimately depends on the increasing the agricultural productivity considerably (Ghatak & Ken, 1984). The share of agricultural production in the total export earning is also substantial and is significant at 12.46 percent in 2015-16.

The poor performance of productivity growth has been associated with industrial stagnation. This can be enhanced by increasing productivity and production, specifically in precedence sectors and by encouraging small-scale sector such as village industries, cottage industries, agro-industries etc with a view to generating employment (Bhatt, 2013). An approachto a strong social, economic as well as political ideology of agro and village

industries was provided by Mahatma Gandhi (Goyal *et al.,*1994).

The stress on agro-based village industries was made in the 1920's by father of the nation as a segment of the independence movement of India. Gandhi Ji once said that India lives in villages. These words of the man of the millionaire are sufficient enough to manifest the well-established and accepted fact that India is basically an agrarian economy and despite tireless efforts for the last seven decades, agriculture continues to occupy a place of pride, being the largest industry in the country.

The village industry also called the cottage industry is a kind of simple work of hands or small machines carried on by villagers in their houses (Acharaya, 2015). By definition, village industry is any industry locating in rural area which produces goods or renders services with or without the use of power and in which the fixed capital asset per head of an artisan or a worker does not overpass one lakh rupees or such other sum as may, by notification in the official gazette, be precise from time to time by the central government (Sarkar *et al.,* 2005).

For eradication of the problems of poverty, unemployment, and inequality as well as building up of the self-reliant socialist economy, it is necessary to develop small-scale village industries, mainly agro-based industries. In India, agro-based industries are provided with high precedence, considering their potential contribution to rural development by using the local agro-based raw material. The growth of agro-based industries is considered a central part of the national growth strategy because of their significance in generating value-addition to the output of agriculture, rising employment and rural incomes and alleviating poverty in the countryside (Government of Punjab, 2008).

India ranks first in the production of gur khandsari industry. During 2015-16 the production of gur khandsari was 638357 thousand MT and its sale was 649180 thousand MT (Government of India 2016a). The gur khandsari, popularly known as kulariin Punjab are set up mainly for the production of gur and shaker.This industry includes various activities like extraction of sugarcane juice, boiling the juice, clarifying the boiling juice with the help sieve, by adding emulsion like the solution in the juice then to convert it into the hard substance called gur. The waste product was used as a fuel for making gur.

OBJECTIVES

Keeping in view the above discussion, the present study was undertaken to work out economics of gur khandsari, an agro-based village industry in Punjab. It also highlights the socio-economic profile of entrepreneurs who were engaged in gur khandsari agro-processing village industries in Punjab.

METHODOLOGY

In order to achieve the objectives, the study was conducted in Punjab through the collection of primary data. The state of Punjab has been divided into three agro-climatic zones, namely sub-mountainous zone, central plain zone, and south-west zone. Multistage sampling technique was adopted for the research. Central zone having the highest number of small-scale units (Government of India, 2014) was selected in the first stage. One district namely, Fatehgarh sahib falling in the central zone was randomly taken, in the second stage. A complete list of all the 444 villages falling under the district was prepared. From the list, forty villages were randomly taken for the study in the third stage. Each village was visited personally to find out the status of gur khandsari - as an agro-based industry. In each village, the Sarpanch or Chowkidar of the village was contacted and guidance about the location of such agro-based industry present in that village was taken. In all villages, total 15 agro-based industrial units (gur khandsari) were found in 40 such villages. The information was collected from the entrepreneurs engaged in these agro-based village industries taken under study by personal interview method. Fixed costs, as well as variable costs, were calculated. The variable costs included raw material costs, labour costs, electricity /diesel costs and interest on variable costs. The net returns were estimated by deducting total cost from gross returns. The output-capital ratio, share of fixed and variable in the output-capital ratio, benefit-cost ratio, benefit-cost ratio at variable and total cost and payback period were calculated by the following formulae:

$$\text{Output – capital ratio} = \frac{\text{Output – Capital ratio}}{\text{Total cost}}$$

$$\text{Share of variable cost in output capital ratio} = \frac{\text{Output – Capital ratio}}{\text{Total cost}} \times \text{variable cost}$$

$$\text{Share of fixed cost in output capital ratio} = \frac{\text{Output – Capital ratio}}{\text{Total cost}} \times \text{fixed cost}$$

$$\text{Payback period} = \frac{\text{Initial fixed investment}}{\text{Annual net returns}}$$

$$\text{Benefit cost ratio (at variable cost)} = \frac{\text{Return over variable cost}}{\text{Variable cost}}$$

$$\text{Benefit cost ratio (at fixed cost)} = \frac{\text{Return over variable cost}}{\text{Variable cost}}$$

RESULTS AND DISCUSSION

Socio-economic Profile of Gur Khandsari Entrepreneurs

As discussed earlier, among forty villages, total 15 gur khandsari industries found under study (Table 1). The socio-economic profile represented the economic and social status of the selected entrepreneurs of gur khandsari industry as agro-based village industries. The

various socio-economic parameters like gender, age, caste, religion, education level, family size, the income of family and debt position, etc. of the entrepreneurs have been analyzed. All the entrepreneurs were male and their average age was 44.3 year. Majority of the entrepreneur of gur khandsari enterprise were married (93.94 percent) belonged to the general category of caste (73.34 percent) and having Sikh religion (73.34 percent). About 60 percent of the entrepreneurs had the nuclear family. Their average numbers of family members were 5.33 and their average years of schooling were 6 years. Average agricultural land ownership of 15 entrepreneurs was 6.83 acres and average limit of credit was 3.39 lakh. About 68.92 percent of the gur khandsari enterprises were located at the residential complex.

Economics of Gur Khandsari Enterprise

Table 2 exhibits the information on the economics of gur khandsari enterprise among different of farm categories entrepreneurs. The various components of total capital investment, total fixed cost and total variable cost of gur khandsari were computed along with gur yield per quintal per enterprise per annum and its market price per quintal was presented. The overall total capital investment (₹220464) in terms of working the land (₹114750), building (₹15700) and various machines (₹112697) per unit per annum. The total fixed cost per unit

Table 1. Socio-economic profile of gur khandsari entrepreneurs

Particulars	Categories	Respondents	Particulars	Categories	Respondents
Gender	Male	15 (100.00)	Caste	General	11 (73.34)
	Female	-		SC	4 (26.66)
Age	20-35	1 (6.66)		BC	-
	36-45	6 (40.00)	Religion	Sikh	11 (73.34)
	46-55	7 (46.67)		Hindu	4 (26.66)
	56-65	1 (6.67)	Agricultural land ownership	Landless	3 (20.00)
Education level	Illiterate	2 (13.33)		Marginal(1-2.5)	2 (13.34)
	Up to primary	2 (13.34)		Small (2.5-5)	2 (13.34)
	Middle	5 (33.33)		Semi-medium (5-10)	4 (26.66)
	Matric	2 (13.34)		Medium (10-25)	4 (26.66)
	Senior Secondary	4 (26.66)		Large (> 25)	-
Family type	Nuclear	9 (60.00)	Credit	Nil	3 (20.00)
	Joint	6 (40.00)		0.50 – 1.00	2 (13.34)
Number of family members	1-2	1 (6.66)		1.00-2.50	2 (13.34)
	3-4	6 (40.01)		2.50-5.00	4 (26.66)
	5-6	3 (20.00)		> 5.00	4 (26.66)
	More than 6	5 (33.33)			
		15 (100.00)			

Figures in the parentheses indicate the percentage to total.

per annum of the entrepreneur those were landless had been worked out as ₹38086 which was lowest among other farm categories. This included interest on fixed capital and depreciation on building and machines which was ₹24251, ₹326 and ₹12210 respectively. The variable cost included the cost of raw material (₹409600), charges of labour (₹24000), cost of electricity (₹70420) and interest on variable cost (₹11760) amount ₹515781 per annum. The gross return included the value of crushing sugarcane per quintal or market price of gur (₹60 per kg). The overall gross returns of landless farmers for per annum were ₹655360which were highest among other farm categories. The net returns of entrepreneurs those were landless ₹101493 per industry per annum.

The total capital investment in terms of working the land (₹29000), building (₹12333) and various machines (₹125000) of entrepreneurs with no land were estimated at ₹166333 per unit per annum. The total fixed cost per unit per annum of entrepreneurs in landless farm category had been worked out as ₹31990 which was lowest among all other farm categories. This included interest on fixed capital and depreciation on building and machines which was ₹18297, ₹306 and ₹13388 respectively. The variable cost included the cost of raw material (₹440000), charges of labour (₹24000), cost of electricity (₹86800) and interest on variable cost (₹12852) amount ₹563652 per annum. The gross returns were computed by taking the value of crushing sugarcane per quintal or market price of gur (₹60 per kg). The gross returns of entrepreneurs of landless farm per annum were ₹704000 which was highest among other farm categories. The net returns of landless entrepreneurs were ₹108358per industry per annum.

Total fixed cost of gur khandsari industry per annum was ₹32836 as against the total capital investment of ₹128675 for entrepreneurs those were marginal farmers. The items of fixed cost in the descending order of importance were interested in capital investment (₹14154), depreciation on building (₹401) and machines (₹11781).

Out of the total variable cost, the total cost of raw material was the most important which were as high as ₹375000. Cost of labour was ₹21000, cost of electricity/diesel/kerosene was ₹72800 and interest on variable cost were ₹10939. The variable cost for entrepreneur those was marginal farmer per annum was ₹479739. The gross return and net return per annum were ₹600000 and ₹87425 respectively in gur khandsari industry.

The results of the study showed that the total fixed

Table 2. Economics of gur khandsari enterprises

(₹)

Particulars	Landless	Marginal	Small	Semi medium	Medium	Overall
A. Capital investment						
1. Land	29000	35000	157500	121750	150750	114750
2.Building	12333	20500	17500	16250	13250	15700
3.Various machines	125000	108175	118700	102237	109375	112698
Total	166333	163675	293700	240237	273375	220464
B. Fixed cost						
1. Interest on capital investment @ 11percent P.A.	18297	14154	32307	26426	30071	24251
2.Depreciation on building @2percent P.A.	306	401	343	319	260	326
3.Depreciation on machinery @ 10percent P.A	13388	11781	12735	11236	11910	12210
4. Land rent	6250	6500	-	-	-	-
Total fixed cost	31990	32836	45385	37980	42241	38086
C. Variable cost						
1.Raw material	440000	375000	420000	415500	397500	409600
2.Labour charges	24000	21000	24000	25500	25500	24000
3.Electricity/diesel cost	86800	72800	67200	61600	63700	70420
4.Interst on variable cost @7 percent P.A	12852	10939	11928	11727	11356	11760
Total variable cost	563652	479739	523128	514327	498056	515781
Total cost (B+C)	595642	512575	568513	552308	540297	553867
D. Gross return	704000	600000	672000	664800	636000	655360
E. Net return (D-B-C)	108358	87425	103487	112492	95703	101493

cost of gur khandsari of small farmers was ₹45385. The various items of fixed cost were similar to that of landless and marginal farm entrepreneurs. Total variable cost per annum per industry was ₹523128. The cost of raw material (₹420000) was the most important item of variable cost. Human labour (₹24000) was the next important item of variable cost of raw material which was followed by electricity charges (₹67200) and interest on variable cost (₹11928). The gross returnswere to the tune of ₹672000 per industry per annum which was the second highest after landless entrepreneurs in gur khandsari industry.

For entrepreneurs with semi medium farm, the fixed cost per industry per annum was ₹37980. The components of total fixed cost in the descending order of their magnitude were interested on capital investment, depreciation on working building and working land. These costs were ₹26426, ₹319 and ₹11236 respectively. Total variable cost per industry per annum was ₹514327. Cost of raw material like sugarcane *rang katt* and soda was₹415500 which were highest in all five land farm categories. Electricity charges (₹61600) and interest on variable cost (₹11727) were other items of variable cost in the descending order of importance. The gross returns were to the tune of ₹664800 and net returns were₹112492 for entrepreneurs with medium farm size.

It was observed that the fixed cost of medium farmers was ₹42241. The cost of raw material was ₹397500. Total variable cost per annum per industry was recorded the third highest for medium farmers were ₹498056. The important items of variable cost were the cost of raw material (₹397500),labour charges ₹25500, expenditure on electricity₹63700 and interest on variable cost₹11356. The gross returns were to the tune of ₹636000 and net returns were₹95703 for entrepreneurs with medium farm size.

Returns and Costs Incurred on all the Farm Categories of Gur Khandsari Entrepreneurs

The perusal of Table 3 revealed that overall variable cost which was ₹515781 cost per annum per unit worked out to be higher as compared to the fixed cost which was ₹38086. The total cost of entrepreneur those was landless worked out to be ₹595642 per unit per annum, was highest among the other farm categories. The returns over variable cost and returns over total cost were highest ₹150473 and ₹32438 for semi medium farmers per annum per unit respectively. For landless entrepreneurs, the gross returns were as high as ₹704000 per annum per industry; yet net returns were found to be₹108358which were lowest from semi medium farm categories. This was because higher total cost later resulted in lower returns. Again, returns over variable cost and returns over total cost were found lowest in the case of entrepreneurs those had small and marginal farms respectively as compared to others. It was ₹140348, ₹120261, ₹103872, ₹150473 and ₹137944 per annum per industry for entrepreneurs in landless, marginal, small, semi medium and medium farm categories respectively.

Economic Evaluation of Gur Khandsari Enterprises

Table 4 represents the economic evaluation of gur khandsari enterprise. The results revealed that BEQ was found highest in the case of landless farms, 6845.36 kg per annum per industry and was lowest in the case of entrepreneurs with small farms which were 5755.12 kg per annum per industry. BEQ as a percentage of actual yield was 58.08 percent on an average in Punjab. It was found highest in the case of entrepreneurs with medium farms (64.26 percent) and lowest in the case of entrepreneurs with small farms(51.38 percent). It showed that the present value of sugarcane crushed was more than the quantity which was required for the survival of gur khandsari enterprise among different farm categories. It was observed that payback period on an average was 2.13 years for the investment of this enterprise. However, it was 1.15 years for entrepreneurs in landless, 1.39 years for marginal, 3.29 years for small, 2.52 years for semi medium and 2.85 years for medium farmers to cover their investment. Increase in investment with the increase in the size of gur khandsari enterprise might be responsible for the longer payback period of the enterprise.

Input-Output Relationship

An attempt was made to find out different ratios of output /benefit in relation to different types of cost concepts (Table 5). The results revealed that by investing one rupee on fixed and variable resources, an amount equal to ₹1.27 on an average in Punjab as is indicated by output-capital ratio. This showed that there were net

Table 3. Returns and costs incurred on all the farm categories of gur khandsari entrepreneurs

(₹)

Particulars	Landless	Marginal	Small	Semi medium	Medium	Overall
Gross return	704000	600000	672000	664800	636000	655360
Fixed cost	31990	32836	45385	37980	42241	38086
Variable cost	563652	479739	523128	514327	498056	515781
Total cost	595642	512575	568513	552308	540297	553867
Return over variable cost	140348	120261	103872	150473	137944	130580
Return over total cost	108358	87425	103487	112492	95703	101493

Table 3 Economic Evaluation of gur khandsari enterprises

(q)

Particulars	Landless	Marginal	Small	Semi medium	Medium	Overall
Actual quantity	11733.33	10000.00	11200.00	11080.00	10600.00	10922.67
Breakeven quantity	6845.36	6149.49	5755.12	6086.41	6812.29	6323.73
BEQ as percent of the actual quantity	58.34	61.49	51.38	54.93	64.26	58.08
Quantity above BEQ	4887.97	2850.50	5444.88	4993.59	3787.71	2791.79
Payback period	1.51	1.39	3.29	2.52	2.85	2.13

Table 5. Input-Output relationship of gur khandsari enterprises

Particulars	Landless	Marginal	Small	Semi medium	Medium	Overall
Output-capital ratio	1.25	1.25	1.28	1.29	1.28	1.27
Benefit-cost ratio	0.25	0.25	0.28	0.29	0.20	0.27
Benefit-cost ratio	0.18	0.18	0.17	0.20	0.17	0.18
The share of fixed cost on output-capital ratio	0.06	0.06	0.10	0.08	0.10	0.08
The share of variable cost in output-capital ratio	1.18	1.19	1.18	1.20	1.18	1.18

earnings of rupee ₹0.21 which came to be 16.69 percent of total earning and remaining 83.31 percent was the total cost on an average of Punjab.

The output-capital ratio was worked out to be 1.25, 1.25, 1.28, 1.29 and 1.28 of gur khandsari for enterprises different in farm categories in Punjab. Out of the gross return per rupee invested, 20, 14.40, 13.28, 22.48 and 13.28 percent were the net returns per rupee while the remaining 80, 85.6, 86.72, 77.52 and 86.72 percent came to be total cost (fixed + variable cost) for gur khandsari in the different farm categories in Punjab. In Punjab on an average, the share of fixed cost in capital-output ratio was lower (6.29 percent) as compared to the share of variable cost (93.38 percent) in gur khandsari enterprise.

CONCLUSIONS

From this study, it is concluded that gur khandsari enterprise is an important mean to earn the daily livelihood of the entrepreneur.It studies revealed that entrepreneurs who had semi medium farms had highest annual net returns (₹112492). The payback periods of gur khandsari enterprise were 2.13 years of the investment of the enterprise. Therefore, gur khandsari enterprise is an enterprise which makes a profit in long run. The average breakeven quantity was estimated to be 6812 kg per annum of sugarcane crushed to make gur was more than the quantity which was required for the survival of the gur khandsari enterprise. The benefit-cost ratio over variable cost was 0.27 and benefit-cost ratio over total cost was 0.18. On average, the share of fixed cost in output-capital ratio was lower (6.29 percent) as compared to the share of variable cost (93.38 percent) in gur khandsari enterprise.

REFERENCES

Acharaya, R. (2015). *Importance of village industries and its problems*. Retrieved from http://www.wisefide.com/2015/11/importance-of-village-industries-and.html.

Bhatt, T.P. (2013, February). *Growth and structural changes in Indian institutes* (pp. 1-65). ISID Working Paper 2013/2. New Delhi: Institute for Studies in Industrial Development. Retrieved from http://isidev.nic.in/pdf/WP1302.pdf

Deshpande, T. (2017). *State of agriculture in India* (Pp. 2-5). Retrieved from http://www.prsindia.org/administrator/uploads/general/1517552563~~Statepercent20ofpercent20Agriculturepercent20inpercent20India.pdf

Ghatak, S., & Ken (1984). *Agriculture and economic development* (Pp. 69). Baltimore MD: Johns Hopkins University Press.

Government of India (2014). *Annual report: 2014-15.* Development Commissioner, Ministry of Micro, Small & Medium Enterprises, Government of India, New Delhi.

Government of India (2016). *Economic survey, 2017*.Economic Advisor, Ministry of Finance, Government of India, New Delhi.

Government of India (2016a). *State industrial profile of Punjab* (pp. 20-21). Ministry of micro, small and medium enterprises, Government of India, New Delhi.

Government of Punjab (2008). *Economic survey of Punjab, 2007-08*. Economic Advisor to Government of Punjab, Chandigarh.

Goyal, S.K. (1994). Policies towards development of agro-industries in India. In G.S. Bhalla (Ed.) *Economic liberalization and Indian agriculture (*Pp. 241–286). New Delhi: Institute for Studies in Industrial Development.

Sarkar, S., & Karan, A.K. (2005). *Status and potentials of village agro- processing unit/industries.* Occasional Paper-37. Mumbai: National Bank for Agriculture and Rural Development.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 383-387
DOI: 10.5958/2322-0430.2018.00085.9

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Availability of Green Fodder in Various Zones of Punjab State

Harparteet Singh, Varinder Pal Singh and Inderpreet Kaur*

College of Dairy Science and Technology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana-141004

**Corresponding author's email: dhindsavp@gmail.com*

Received: December 29, 2017 *Manuscript Number: NS-18-49* *Revision Accepted: February 28, 2018*

ABSTRACT

The present study covers three districts across three agro-climatic zones of Punjab state viz. Sub mountainous zone, Central zone and South Western zone for estimating the availability, requirement, and deficit of green fodder in the state. It has been observed that fodder area in the state is increasing over time. It was 7.74 lakh ha during 2000-01 (9.75 percent of gross cropped area), and 8.85 lakh ha (11.24 percent of gross cropped area) during 2015-16. During 2015-16, the area under fodder crops has further increased to 8.95 lakh ha. Similarly, production of fodder crops has increased from 44.93 million tonnes during 2000-01 to 57.48 million tonnes during 2016-17. The green fodder deficiency in Punjab state was estimated to be 22.99 million tonnes which were 28.57 percent of the total green fodder requirement. In a zone wise analysis, the highest deficiency was in Central zone (27.96 percent) followed by South Western zone with 7.59 million tonnes (38.49 percent) and Sub Mountainous zone with 1.34 million tonnes (12.80 percent). The green fodder production can be substantially enhanced either by increasing the fodder area or improving the yield levels. The more emphasis should be on improving the yield levels as area available for cultivation has almost stagnated; rather it has started declining over the years.

Keywords
Area under fodder crops, deficiency, gross cropped area, production, yield.

JEL Codes
Q12, Q13.

INTRODUCTION

India is basically an agricultural country and about 55-60 percent population depends on agriculture, livestock and allied sectors for livelihood. Livestock has been an integral component of India's agricultural and rural economy since time immemorial. Although India has a very large population of livestock, the productivity of milk per animal is very low compared to other many countries in the world. One of the main reasons for low productivity of livestock is malnutrition, under nutrition or both, besides the low genetic potential of animals. The country is highly deficient in respect of availability of green fodder, dry fodder and concentrates. The deficit of green fodder currently is 35 percent (Planning Commission of India, 2012). Any attempt towards enhancing green fodder availability would result in anincreased margin of profits to livestock owners. The area under fodder crops in India has stagnated at about 8.5-9.0 million hectares during the past decade and accounts for only about 4.6 percent of the total cultivated area. The projected green fodder and dry fodder demand for 2020 are 1134 and 630 million tonnes, whereas, the availability is expected to stand at 406 and 473 million tonnes leaving a shortage of 64 and 25 percent, respectively (Srivastava, 2017). Standing at 40 percent even today, the availability of good quality upgraded fodder seeds and conservation of fodder either as silage or hay remains a major concern (Narke, 2017). For enhancing the overall productivity of the dairy sector, a steady and adequate supply of quality fodder is required for supporting the livestock population. The feed given to milch animals comprises of green fodder, dry fodder and concentrates.

Among the livestock products, milk is the most important. The economic viability of milk production heavily depends on the source (s) of feed and fodder as feeding cost account for about 70-75 percent of the total variable cost of dairy farming. Green fodder is the essential component of feeding milch animals to obtain the optimum level of milk production which accounts for about 44 percent of the feed and fodder expenditure (Kaur *et al.,* 2012). Apart from that, green fodder crops are

known to be a cheaper source of nutrients as compared to concentrates and hence helpful in bringing down the cost of feeding and thereby leading to higher profitability. Hence, any effort towards enhancing green fodder productivity and production will go a long way in improving the green fodder availability and will be helpful in bringing down the cost of feeding and thereby leading to higher profitability.

When it comes to enhancing the productivity of Punjab's dairy sector, ensuring an adequate supply of reasonable quality feed and fodder is one of the major challenges. The tremendous pressure of livestock on available feed and fodder resources and consequent dismal scenario of fodder inadequacy has been the major impediment to the sustained growth of the dairy sector. The deficit of green fodder is estimated to be 46.38 percent in the state (Kaur *et al*., 2014). Efforts need to be made for reducing the gaps between requirement and availability of green fodder by technological interventions to increase the fodder yields and conservation of fodder. The present study, in this direction, has been aimed to study the regional availability, requirements, and deficit if any of green fodder in Punjab. The study provides useful information to future researchers and stakeholders in the dairy sector

METHODOLOGY

The study was conducted in three agro-climatic zones of Punjab state viz. Sub Mountainous zone (comprising of Sahibzada Ajit Singh Nagar, Rupnagar, Shaheed Bhagat Singh Nagar, Hoshiarpur and Pathankot districts with a total geographical area of 820 thousand ha (16.29 percent)), Central zone (comprising of Amritsar, Gurdaspur, Tarn Taran, Jalandhar, Kapurthala, Ludhiana, Barnala, Moga, Sangrur, Patiala and Fatehgarh Sahib districts with a total geographical area of 2725 thousand ha (54.14 percent)) and South Western zone (comprising of Bathinda, Sri Muktsar Sahib, Mansa, Faridkot, Firozpur and Fazilka districts with a total geographical area of 1488 thousand ha (29.57 percent)). Secondary data has been used for accomplishing the objectives of the study. The secondary data on area, production and productivity under fodder crops and livestock population in selected districts were collected from the various published sources like Basic Animal Husbandry Statistics, Statistical Abstract of Punjab and Animal Husbandry Department, Punjab. The availability of green fodder was calculated by dividing the total green fodder production with a number of adult bovine.The young ones and heifers were converted into adult units by considering three young one and heifers equal to one adult unit. The requirement of green fodder was worked out by considering recommended 40 kg green fodder required per adult animal per day.In order to accomplish the objectives of the study, appropriate statistical tools and techniques like averages and percentages etc. were used to draw relevant inferences.

RESULTS AND DISCUSSION

Area under Fodder Crops and Gross Cropped Area Overtime in Punjab

The area under fodder crops and thegross cropped area in Punjab state have been presented in Table 1 and

Table 1. Area under fodder crops and gross cropped area overtime in Punjab

(Lakh ha)

Years	Area under fodder crops	Gross cropped area (GCA)	Fodder area as percent of GCA
2000-01	7.74	79.41	9.75
2007-08	6.45	78.70	8.20
2010-11	8.46	78.82	10.73
2014-15	8.79	78.57	11.19
2015-16	8.85	78.72	11.24
2016-17	8.95	NA	NA

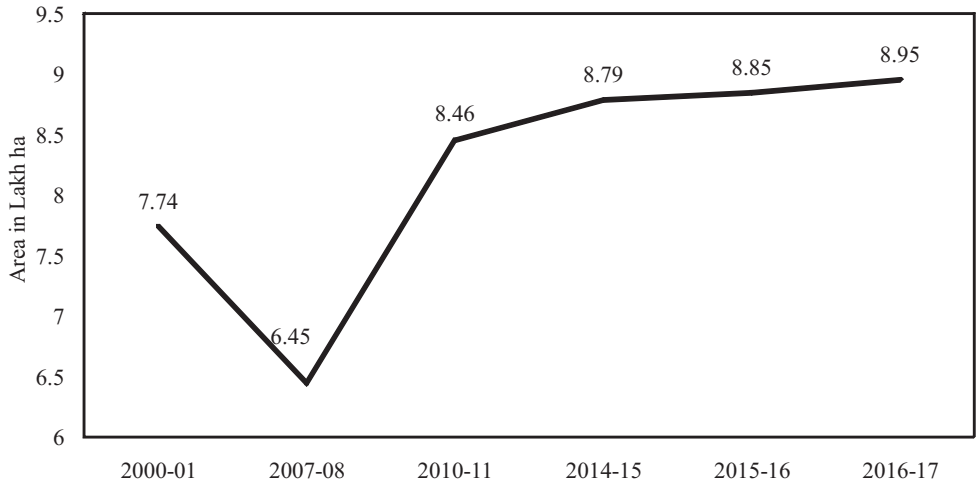


Figure 1. Area under fodder crops in Punjab over time

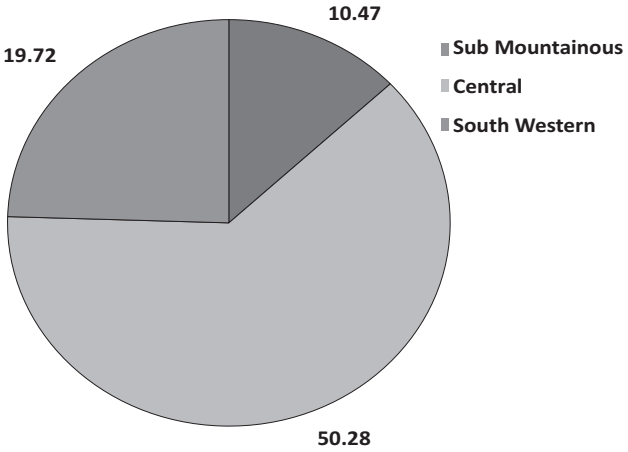


Figure 2. Requirement of green fodder in various zones of Punjab state (Million tonnes)

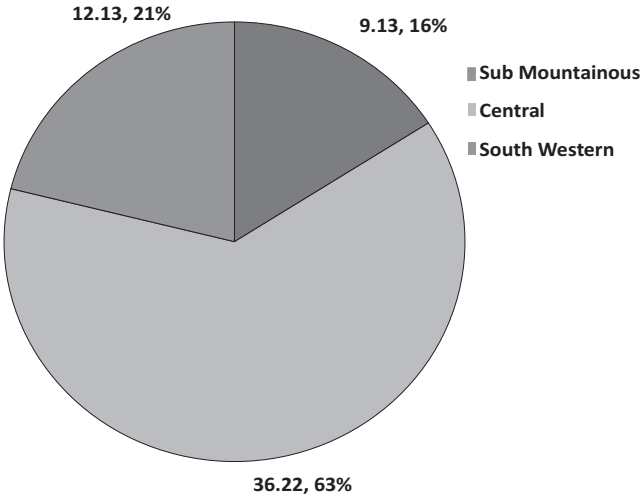


Figure 3. Availability of green fodder in various zones of Punjab state (Million Tonnes)

Figure 1. A perusal of the table brought out that the gross cropped area has almost stagnated since 2000-01 in the state. It was 79.41 lakh ha during 2000-01 and declined slightly to 78.72 lakh ha during 2015-16. Regarding area under fodder crops, it has been observed that fodder area in the state is increasing over time. It was 7.74 lakh ha during 2000-01 (9.75 percent of gross cropped area), increased to 8.46 lakh ha (10.73 percent of gross cropped area) during 2010-11 and 8.85 lakh ha (11.24 percent of gross cropped area) during 2015-16. During 2016-17, the area under fodder crops has further increased to 8.95 lakh ha.

Production and Yield of Fodder Crops in Punjab Over Time

Production and yield of fodder crops over time in Punjab in various zones of Punjab state is presented in Table 2. A perusal of table showed that production of fodder crops has increased from 44.93 million tonnes during 2000-01 to 57.48 million tonnes during 2016-17. The yield of fodder crops has increased from 580.56 to 642.22 q/ha during the same period. Season wise, in *rabi* season, the production of fodder crops has increased from 26.53 million tonnes during 2000-01 to 28.80 million tonnes during 2016-17. There was no significant

Table 2. Production and yield of fodder crops over time in Punjab

(Production: Million tonnes, Yield: q/ha)

Years	*Rabi*		*Kharif*		Total	
	Production	Yield	Production	Yield	Production	Yield
2000-01	26.53	834.43	18.40	403.51	44.93	580.56
2007-08	25.03	774.69	17.16	532.58	42.19	653.81
2010-11	25.35	754.56	25.24	495.23	50.59	598.27
2014-15	26.61	756.77	26.55	503.77	53.16	605.02
2015-16	26.39	741.72	26.74	504.94	53.13	600.11
2016-17	28.60	796.16	28.88	539.02	57.48	642.22

Table 3. Fodder availability and deficiency in various zones of Punjab state during 2016-17

Zone	Adult Bovine Population (thousand)	Area under fodder (Lakh ha)	Fodder requirement (Million tonnes)	Fodder availability (Million tonnes)	Deficiency	
					Quantity (Million tonnes)	Percent of requirement
Sub Mountainous	717.40	1.54	10.47	9.13	1.34	12.80
Central	3443.82	5.40	50.28	36.22	14.06	27.96
South Western	1350.37	2.01	19.72	12.13	7.59	38.49
Punjab	5511.59	8.95	80.47	57.48	22.99	28.57

Table 4. Zone wise requirement to increase area under fodders or yield of fodder crops in Punjab state

Zone	Existing area under fodder (Lakh ha)	Area under fodder required* (Lakh ha)	Existing yield of fodders (q/ha)	Yield of fodder required** (q/ha)
Sub-Mountainous	1.54	1.77	591.02	677.76
Central	5.40	7.50	670.89	931.32
South Western	2.01	3.26	604.48	982.72
Punjab	8.95	12.53	642.22	899.08

Average yield of fodder remaining same.
****Area under fodder remaining same.***

improvement in the yield of fodder crops during above mentioned period except during 2016-17. In Kharif season, the production of fodder crops has increased from 18.40 million tonnes during 2000-01 to 28.88 million tonnes during 2016-17. The yield of fodder crops has augmented from 403.51 to 539.02 q/ha during the same period.

Fodder Availability and Deficiency in Various Zones of Punjab

Zone wise green fodder requirement, availability, and deficiency in the Punjab state is presented in Table 3 and Figure 2 and 3. Overall in Punjab state, the green fodder requirement was estimated to be 80.47 million tonnes out of which maximum requirement were in a Central zone (50.28 million tonnes) followed by South Western zone with 19.72 million tonnes and Sub Mountainous zone (10.47 million tonnes).The fodder availability in the state was worked out to be 57.48 million tonnes which were the highest in the Central zone with 36.22 million tonnes followed by 12.13 million tonnes in South Western zone and 9.13 million tonnes in Sub Mountainous zone. The green fodder deficiency in Punjab state was estimated to be 22.99 million tonnes which were 28.57 percent of the total green fodder requirement. In a zone wise analysis, the highest deficiency was in Central zone (27.96 percent) followed by South Western zone with 7.59 million tonnes (38.49 percent) and Sub Mountainous zone with 1.34 million tonnes (12.80 percent). By 2020 India would require 855 million tonnes of green fodder according to the study by Dixit & Birthal (2010). Raju (2013) found that dry matter availability through greens on all India bases has increased to 168.66 million tonnes in 2011-12 from 147.66 million tonnes in 1980-81. The obvious reason for lower green fodder deficit in Sub Mountainous zone was the relatively higher proportion of fodder area compared to the proportion of adult bovines or in other words, we can say there is less pressure of animals per unit of fodder area in Sub Mountainous zone. There is urgent need to reduce the green fodder deficiency for sustainable dairy development in Punjab state especially in South Western and Central zone.

Zone-wise Requirement to Increase Area or Yield of Fodder Crops

The Table 4 presents zone wise requirement to increase area or yield of fodder crops so as to reduce the gaps in demand and supply of green fodder. It is revealed from the table that if the yield levels of fodder crops remain same, then the area under fodder crops will have to be increased to 12.53 lakh ha to meet the fodder requirement which will be 15.92 percent of the gross cropped area in the state. In a zone wise analysis, the requirement of the area under fodder crops will be 7.49 lakh ha, 3.26 lakh ha and 1.77 lakh ha in Central, South Western and Sub Mountainous zones, respectively. On the other hand, if thearea is to be kept constant, then the yield level of fodder crops has to be increased to 899.08 q/ha instead of existing 642.22 q /ha to meet the fodder requirement.

In a zone-wise analysis, the requirement of yield will be 982.72 q/ha, 931.32 q/ha and 677.76 q/ha in South Western, Central and Sub Mountainous zones, respectively. Kaur (2008) found that total area under fodders in the state had to be increased from 569.83 thousand hectares to 1062.67 thousand hectares which would be about 13.51 percent of the total cropped area against the existing area of 7.22 percent. Therefore, the green fodder production can be substantially enhanced either by increasing the fodder area or improving the yield levels. The more emphasis should be improving the yield levels as area available for cultivation has almost stagnated; rather it has started declining over the years.

CONCLUSIONS

From the foregoing discussion, it may be concluded that the state is deficient in green fodder. The green fodder deficiency was estimated to be 22.99 million tonnes which were 28.57 percent of the total green fodder requirement. Therefore, every effort towards increasing the green fodder availability will go a long way for the sustainable dairy development in the state. Green fodder production can be substantially enhanced either by increasing the fodder area or improving the yield levels. The area under fodder crops will have to be increased by 3.58 lakh ha at existing yield level to meet the fodder requirement. On the other hand, if the area is to be kept constant, then the yield level of fodder crops has to be increased by 257q/ha. Here, the focus should be on the mixed approach. The more emphasis should be given for

improving the yield levels of existing varieties and developing new high yielding and nutritious varieties as area available for cultivation has almost stagnated, rather it has started declining over the years and hence the fodder area cannot be increased indiscriminately.

REFERENCES

Dixit, A.K., & Birthal, P.S. (2010). India's livestock feed demand: Estimates and projections. *Agricultural Economics Research Review,23*(1), 15-28.

Kaur, I., Singh, V.P., Kaur, H., & Singh, P. (2012).Cost-benefit analysis of cow milk production in Punjab.*Journal of Agricultural Development and Policy, 22*(1), 67-74.

Kaur, P. (2008). *Role of dairy farming in the structural transformation of agriculture in Punjab* (Doctoral Thesis). Punjab Agricultural University, Ludhiana, India.

Kaur, P., Bhullar, A.S., Kaur, I., & Kaur, H. (2014). *Growth and performance of the dairy sector in Punjab.* In Inderjit Singh, Sukhwinder Singh & Lakhwinder Singh (Ed) *Punjab's economic development in the era of globalisation.* Delhi: LG Publishers Distributors, pp 141-57.

Narke, A. (2017). From the president's desk. *Indian Dairyman,69*(2), 16-17.

Planning Commission of India. (2012). *Report of the working group on animal husbandry and dairying for the five-year plan (2012-2017).* Planning Commission of India, Government of India, New Delhi.

Raju, S.S. (2013). *Assessment of animal feed resources in India.* National Centre for Agricultural Economics and Policy Research, New Delhi.

Srivastava, A.K. (2017). Inaugural address.*Indian Dairyman,69*(4), 42-45.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 388-394
DOI: 10.5958/2322-0430.2018.00086.0

NAAS Score: 4.82
www.naasindia.org
UGC Approved

A Temporal Analysis on Population and Production of Livestock Sector in India with Special Reference to Punjab

Namami Gohain and P.K.S. Bhangu*

Department of Economics and Sociology, PAU, Ludhiana-141004, Punjab

**Corresponding author's email: jeniffertime@gmail.com*

Received: December 31, 2017 *Manuscript Number: NS-18-67* *Revision Accepted: February 18, 2018*

ABSTRACT

The present study focuses on the overtime growth of population and production of livestock and poultry sector in India and Punjab. Total livestock population in India increased during the period of 1997 to 2012 whereas Punjab showed negative growth. An increase in the poultry population is seen in India as well as in Punjab. Livestock and poultry production has shown positive growth both in Punjab and India. But the per capita availability for eggs and other livestock products is still less than the recommended level. Per availability of milk in Punjab is more than recommended level.

Keywords
Bovines, ovines, per capita availability, population, poultry, production.

JEL Codes
O13, P42, Q10, Q19.

INTRODUCTION

India's livestock sector is one of the largest in the world and is an important subsector of Indian agriculture. It plays an important role in the national economy and for the socio-economic development of our country. Livestock sector makes multifarious contribution to overall welfare of India's rural population in terms of generating more employment opportunities, especially for the marginal and small farmers and landless labourers, alleviating poverty and stabilizing farm income (Borah & Halim, 2014). The report of the working group on animal husbandry and dairying11thFive Year Plan, 2007-12 states that this sector employs eight percent of the country's labour force. Growth in livestock sector has more potential to reduce poverty to a similar growth in crop sector (Birthal & Taneja, 2006). Punjab is a small state in India covering only 1.5 percent geographical area of the country. The state of Punjab in India has been one of the world's most remarkable examples of agricultural growth (Dhawan & Singh, 2015). But the existing rice-wheat farming system of the state has paved the way for over-exploitation of water resources and land. Hence livestock sector can prove to be one of the remunerative alternatives to the wheat-rice system thereby providing income and employment on a sustainable basis. The total livestock population consisting of Cattle, Buffalo, Sheep, Goat, pig, Horses and Ponies, Mules, Donkeys, Camels, Mithun, and Yak in the country is 512.05 million numbers in 2012 whereas in Punjab the number stood at 8.1 million. Despite this large population and good growth, productivity of the stock is low in the country and per capita availability of all the products is still lower than their respective ICMR recommendation (Basic animal husbandry statistics, 2006, 2010; Government of India, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhawan, New Delhi). The contribution of livestock sector to the food basket in the form of milk, eggs, and meat has been immense in fulfilling the animal protein requirement of the ever-growing human population (Sharma, 2004). Besides, it supplies draught power and organic manures to the crop sector and hides, skin, bones, blood and fibres to the industries. In addition, it provides for environmental conservation by utilizing huge amount of crop residues and by-products as feed/fodder and supplying non-renewable energy sources in terms of dung and draught

power. Hence the government should take initiatives to encourage and uplift the agro-based industries of the country by means of providing subsidies, imposing minimum tax, cheap electricity facilities and the like. The main objective of the paper is to analyze the growth in population, production and per capita availability of major livestock and poultry products.

METHODOLOGY

The paper is divided into two sections. The first section emphasizes on population aspect of the livestock sector of Punjab and India whereas the second section presents the production of various livestock and poultry products. The study is mainly based on secondary data. The data on livestock and poultry population, production and per capita availability of major livestock and poultry products were collected and compiled from various published sources like Livestock census, various census reports, reports of Animal Husbandry Statistics Division, Dept. of Animal Husbandry, Dairying and Fisheries and the website of indiastat.com. Analytical tools such as simple averages, percentages, and tabular analysis were employed for the study. Compound annual growth rates were computed to show the status of production of different livestock and poultry products. Inter-census period growth rates in livestock and poultry population were computed using the following formula:

$$P_t = P_0 e^{rt}$$

$$r \quad \frac{In \ \frac{Pt}{Po}}{t} \quad 100$$

Where Pt is population in the tth period, Po is population in the base period and r is the growth rate.

Compound annual growth rates (CAGR) of production of different livestock products was estimated using the following formula:

$Y = ab^t$ or $\log y = \log a + t \log b$

Where, Y= production, a= constant, b= regression coefficient, t= time (1,2,…,n)

The compound annual growth rate was worked out as

CAGR (r) = (b*-1) × 100

Where b* = antilog of estimate of b.

RESULTS AND DISCUSSION

Composition of Livestock Population of India

Over the years, a significant increase in the demand for livestock products is witnessed owing to rapid urbanization, changing lifestyle, rising income levels, increased nutritional awareness etc. This led to an increase in almost all the livestock species across the world. India, among other countries, is bestowed with a one of the largest livestock wealth in the world. Its position in the world in terms of livestock and poultry population is quite impressive, being first in case of buffalo and goat; second for sheep and cattle, fifth for chicken, eighth and ninth for duck and camel respectively (Government of India, 2014). The composition of livestock population in broad groups like bovine (cattle and buffaloes), ovine (sheep and goats), pigs and poultry, however, has changed over the last two decades. Cattle population showed a big leap of change but with negative growth rate mainly due to the prohibition of cow slaughter on the religious ground especially in India (Khan & Iqubal, 2008).The livestock census 2012 revealed that the total livestock population declined from 530 million in 2007 to 512 million in 2012 (Table 1). However, the percentage change in livestock population from 1997 to 2012 was computed to be 5.5 percent and a decline in the number of cattle, camels and pigs population was seen during the same period. The total bovine population stood at 299.60 million numbers in 2012, which showed an increase of 3.80 percent over 1997 census. Buffalo population increased from 90 million in 1997 to 109 million in 2012 with an increase of 20.9 percent. An increase of 13 and 10 percent in the population of sheep and goat respectively was observed in the 2012 over 1997

Table 1. Category-wise population of livestock in India

(Million No.)

Category	1997	2003	2007	2012	Percent change (1997 to 2012)
Total cattle	198.88	185.18	199.07	190.90	-4.01
Buffalo	89.91	97.92	105.34	108.70	20.90
Horses and ponies	0.83	0.75	0.61	0.63	-24.10
Donkeys	0.88	0.65	0.44	0.32	-63.64
Mules	0.22	0.18	0.14	0.2	-9.09
Camels	0.91	0.63	0.52	0.4	-56.04
Sheep	57.49	61.46	71.55	65.06	13.17
Goat	122.72	124.35	140.53	135.17	10.15
Pigs	13.29	13.51	11.13	10.29	-22.57
Total livestock	485.39	485.00	529.69	512.05	5.49
Poultry	347.61	489.01	648.82	729.20	109.78

Source: Livestock Census Report 2012.

Table 2. Species-wise inter-census period growth rate (percent) of livestock and poultry population in India 1997-2012

Category	1997	2003	2007	2012
Total cattle	-	-1.19	0.01	-0.27
Buffalo	-	1.42	1.58	1.27
Bovines	-	-0.34	0.53	0.25
Horses and ponies	-	-1.69	-3.08	-1.84
Donkeys	-	-5.05	-6.93	-6.74
Mules	-	-3.34	-4.52	-0.64
Camels	-	-6.13	-5.60	-5.48
Sheep	-	1.11	2.19	0.82
Goat	-	0.22	1.36	0.64
Pigs	-	0.27	-1.77	-1.71
Total livestock	-	-0.01	0.87	0.36
Poultry	-	5.69	6.24	4.94

census. Poultry population of the country increased to 729 million as compared to 348 million in 1997. Species-wise inter-census growth rate of livestock and poultry population is shown in Table 2. Positive growth rate was seen in the case of buffalo, sheep, goat, and poultry population in the year 2003, 2007 and 2012 respectively. Whereas growth rate of cattle population was positive only for 2007. Camels, donkeys, mules and horses exhibited negative growth rates in all the years.

Cattle and buffalo alone constitute 51 and 50 percent of the total livestock population in 2007 and 2012 respectively as shown in Table 3, whereas including goat and sheep increases the value to 97 percent in both the years. The state-wise percentage share of cattle and buffalo population in 2012 is shown in Table 4. The state with the highest share of cattle population in the country is Madhya Pradesh (10.27 percent) followed by Uttar Pradesh (10.24 percent) and West Bengal (8.65 percent). On the other hand, Uttar Pradesh has the highest share of buffalo population in the country which stands at 28.17 percent followed by Rajasthan (11.94 percent) and Andhra Pradesh (9.77 percent). The results presented in Table 5 also show that Punjab has about 4.75 percent of India's buffalo population. It can be seen that Rajasthan (16.03 percent) has the highest population of Goats in the country followed by Uttar Pradesh (11.53 percent) and Bihar (8.99 percent) as shown in Table 5. Andhra Pradesh owns about 40.57 and 22.12 percent of India's sheep and poultry being the highest in the country.

Table 3. Distribution of population of livestock (percent) in 2007 and 2012

Category	2007	2012
Cattle	37.58	37.28
Goat	19.89	21.22
Buffalo	13.51	12.71
Sheep	26.53	26.40
Pigs	2.10	2.01
Others	0.39	0.37
Total	100	100

Source: Livestock Census Report 2012.

Composition of Livestock Population of Punjab

Bovine population in Punjab was estimated to be 88.1 lakhs during 1997 census which decreased to 80.32 lakhs during 2003 census, and it further decreased to 73.43 lakhs during 2012 census. Table 6 revealed that the cattle and buffalo population trend has been decreasing over the years with a negative percentage change of -8.03 percent for cattle and -16.36 percent per year for Buffalo from 1997 to 2012. Cattle population showed a big leap of change but with negative growth rate mainly due to the prohibition of cow slaughter on the religious ground especially in India (Khan & Iqubal, 2008). The focus of poor livestock households is on small animals like goat, pig, and poultry requiring quick returns. This multiple species animal husbandry system is also environment-friendly (Grover & Kumar, 2012). The ovine population which was 8.50 and 4.98 lakhs during 1997 and 2003 census decreased to 4.56 lakhs during 2012. Poultry population increased from 54.6 lakhs during 1997 to 167.9 lakhs in 2012 as indicated by a positive inter-census growth rate of 7.49 percent as shown in Table 7. The inter-census growth rate has been found to be positive for poultry population in all the years. The results also revealed negative growth rates for all the other species in all the years. Livestock population in Punjab declined over the years as depicted by negative growth rates shown in Table 7. One of its reasons being decrease in the utilization of livestock as draught power due to mechanization of agricultural operations and decreasing farm size. Punjab has about 4.74 and 2.30 percent of the country's buffalo and poultry respectively as shown in Table 8.

Production of Livestock and Poultry Products

Milk production

The growth in the milk production remained stagnant for more than two decades after independence (around 1

Table 4. State wise percentage share of cattle and buffalo population in 2012

State	Percent share of cattle population	State	Percent share of buffalo population
Madhya Pradesh	10.27	Uttar Pradesh	28.17
Uttar Pradesh	10.24	Rajasthan	11.94
West Bengal	8.65	Andhra Pradesh	9.77
Maharashtra	8.11	Gujarat	9.55
Rajasthan	6.98	Madhya Pradesh	7.53
Bihar	6.41	Bihar	6.96
Odisha	6.09	Haryana	5.6
Assam	5.4	Maharashtra	5.15
Gujarat	5.23	Punjab	4.75
Chhattisgarh	5.14	Karnataka	3.19
Andhra Pradesh	5.03	Others	7.38
Others	8.28		

Table 5. State wise percentage share of goat, sheep and poultry population in 2012

State	Percent share of goat population	State	Percent share of sheep population	State	Percent share of poultry population
Rajasthan	16.03	Andhra Pradesh	40.57	Andhra Pradesh	22.12
Uttar Pradesh	11.53	Karnataka	14.73	Tamil Nadu	16.09
Bihar	8.99	Rajasthan	13.95	Maharashtra	10.67
West Bengal	8.51	Tamil Nadu	7.36	Karnataka	7.33
Andhra Pradesh	6.71	J & K	5.21	West Bengal	7.25
Maharashtra	6.24	Maharashtra	3.97	Haryana	5.87
Tamil Nadu	6.02	Gujarat	2.62	Assam	3.73
Madhya Pradesh	5.93	Odisha	2.43	Kerala	3.33
Jharkhand	4.87	Uttar Pradesh	2.08	Chhattisgarh	3.17
Odisha	4.56	West Bengal	1.65	Odisha	2.73
Assam	3.67	Himachal Pradesh	1.24	Uttar Pradesh	2.56
Others	6.18	Others	4.2	Others	10.78

Table 6. Livestock population statistics in Punjab

(Lakhs)

Species	1997	2003	2007	2012	Percent change (1997-2012)
Cattle	26.39	20.38	17.60	24.27	-8.03
Buffalo	61.70	59.94	50.02	51.60	-16.36
Horses and ponies	0.34	0.29	0.30	0.33	-2.94
Donkeys	0.17	0.09	0.04	0.03	-82.35
Mules	0.22	0.05	0.09	0.05	-77.27
Sheep	4.36	2.20	2.11	1.29	-70.41
Goat	4.14	2.78	2.86	3.27	-21.01
Camels	0.29	0.03	0.02	0.01	-96.55
Pigs	0.93	0.29	0.24	0.32	-65.59
Total livestock	98.57	86.07	73.65	81.17	-17.65
Poultry	54.6	107.7	188.99	167.9	207.51

Source: indiastat.com.
Figures in parentheses indicate percentage share to total livestock.

Table 7. Species-wise inter-census period growth rate (percent) of livestock and poultry population in Punjab 1997-2012

Category	1997	2003	2007	2012
Total cattle	-	-4.31	-4.05	-0.56
Buffalo	-	-0.48	-2.10	-1.19
Horses and ponies	-	-2.65	-1.25	-0.20
Donkeys	-	-10.60	-14.47	-11.56
Mules	-	-24.69	-8.94	-9.88
Sheep	-	-11.40	-7.26	-8.12
Goat	-	-6.64	-3.70	-1.57
Camels	-	-37.81	-26.74	-22.45
Pigs	-	-19.42	-13.55	-7.11
Total livestock	-	-2.26	-2.91	-1.29
Poultry	-	11.32	12.42	7.49

percent per annum) whereas the growth of population was closer to 2 percent (Government of India, 2014). The gap between demand and production was widening. Substantial increment in milk production was achieved with the launch of a nationwide dairy development

Table 8. Species-wise livestock and poultry: Punjab and India, 2012

Species	Number (in lakhs)		Percentage share of Punjab
	Punjab	India	
Cattle	24.27	1909.04	1.27
Buffaloes	51.59	1087.02	4.74
Sheep	1.28	650.69	0.19
Goats	3.27	1351.73	0.24
Pigs	0.32	102.93	0.31
Poultry	167.94	7292.09	2.30

programme (operation flood) in the year 1970 (Gautam *et al.,* 2010). It has been estimated that demand of milk will rise to 156 million tons by 2020 (Parthasarathy *et al.,* 2004). Estimates by the Planning Commission of India indicate still higher demand increases (182 million tons by the year 2021–22). With an annual milk production of 155.5 million tonnes, India ranks first in the world. Punjab has contributed significantly to the milk production in the country which increased from 7.77 in 2000-01 to 10.77 million tonnes in 2015-16. The state contributed about 7 percent of total milk production in India during 2015-16. The per capita availability of milk in India increased from 223g per day in 2000-01 to 337g per day in 2015-16 which is above the recommendation of ICMR (300g per day). Per capita availability of milk is highest in Punjab (1032g/day). The state with the highest milk production in the country is Uttar Pradesh contributing about 16.96 percent of total milk produced in the country followed by Rajasthan (11.89 percent) and Gujarat (7.88 percent) as shown in Table 10.

Egg production

From the year 1999-2000 onwards the production of egg improved substantially and it reached 82929 million in 2015-16. Egg production in Punjab increased from 2964 million in 2000-01 to 5058 million in 2015-16. Per capita availability of eggs per annum is higher in Punjab as compared to the national level. In India, per capita availability of eggs increased from 36 eggs per annum in 2000-01 to 62 eggs per in year 2015-16 whereas in Punjab the increase was from 121 to 178 eggs which is still below

Table 9. Milk and egg production in Punjab vs India

Year	Milk Production				Egg production			
	Total (million tonnes)		Per capita availability (g/day)		Total (million)		Per capita availability (Number/annum)	
	India	Punjab	India	Punjab	India	Punjab	India	Punjab
2000-01	81.43	7.77	223	870	36632	2964	36	121
2005-06	97.07	8.90	241	931	46235	3520	42	134
2006-07	100.22	9.16	247	939	50663	3774	45	141
2007-08	107.93	9.28	249	923	53583	3791	47	138
2008-09	112.18	9.38	264	920	55562	3679	48	132
2009-10	116.42	9.39	273	915	60267	3283	51	117
2010-11	121.85	9.42	281	931	63024	3544	53	128
2011-12	127.90	9.55	290	944	66450	3603	55	131
2012-13	132.4	9.72	299	961	69731	3791	58	137
2013-14	137.7	10.01	307	980	73438	4337	61	155
2014-15	146.3	10.35	322	1003	78484	4849	62	162
2015-16	155.5	10.77	337	1032	82929	5058	63	178

Source: www.indiastat.com.

Table 10. Top ten egg and milk producing states in India 2015-16

Egg			Milk		
State	Production (Million No.)	Percent share	State	Production (000't)	Percent share
Tamil Nadu	16125	19.44	Uttar Pradesh	26378	16.96
Andhra Pradesh	14174	17.09	Rajasthan	18500	11.89
Telangana	11206	13.51	Gujarat	12262	7.88
West Bengal	6011	7.24	Madhya Pradesh	12148	7.81
Maharashtra	5286	6.37	Andhra Pradesh	10817	6.95
Haryana	4913	5.92	Punjab	10774	6.92
Karnataka	4766	5.74	Maharashtra	10153	6.52
Punjab	4422	5.33	Haryana	8381	5.39
Kerala	2443	2.94	Bihar	8288	5.33
Uttar Pradesh	2193	2.64	Tamil Nadu	7244	4.65
India	82929	100	India	155491	100

Source: www.data.gov.in, DAHD.

the ICMR recommendation of 180 eggs/ annum. It is seen in Table 10 that egg production is highest in Tamil Nadu which is 19.44 percent of total egg production followed by Andhra Pradesh and Telangana contributing 17.09 and 13.51 percent respectively. Punjab stands eighth with a share of 5.33 percent of total egg production in India.

Meat production

In India, there has been a continuous increase in the total meat production owing to a considerable rise in non-vegetarian population over time. Nearly 45 percent of the production of meat is contributed by poultry alone. Buffalo, Goat, Pig, Sheep, and Cattle contribute 19, 16, 8, 7 and 5percent of total meat production respectively (Government of India, 2014). Recent trends, however, indicate improvements in meat yield of cattle, buffalo and sheep, and a decline in meat yield of goat and pig. Increasing population, urbanization and sustained rise in per capita income are fueling rapid growth rate in demand for animal food products in India (Birthal & Taneja, 2006). In Punjab, the numbers of slaughter houses remains same throughout the year. Sheep and goat had maximum share among slaughtered animals and their number was 4,47296 in 1980-81 which increased to 650490 in 2013-14 having grown rate of 1.12 percent. The number of slaughtered pigs were 14563 during year 1980-81 which increased to 12689 in 2013-14 showing 0.42 percent growth (Dhawan & Kashish, 2016).

Wool Production

In India, total wool production has increased from 27.5 million kg in1950-51 to 43.6 million kg in 2015-16. Wool production is maximum in Rajasthan followed by Karnataka, Jammu and Kashmir, Telangana, and Gujarat as shown in Table 11.

Table 11. Top ten wool producing states in India 2015-16 (Million Kg)

State	Production	Percent share
Rajasthan	13.4	30.73
Karnataka	8.2	18.80
J & K	6.9	15.82
Telangana	4.6	10.55
Gujarat	2.3	5.27
Maharashtra	1.4	3.21
Himachal Pradesh	1.4	3.21
Uttar Pradesh	1.3	2.98
Andhra Pradesh	0.8	1.83
West Bengal	0.7	1.60
India	43.6	100

Source: data.gov.in, DAHD.

Growth rate of production of livestock and poultry products

Compound annual growth rate (CAGR) of production of major livestock products in India is presented in Table 12. The compound growth rate for milk was 1.64 percent in period of 1950-60 which increased to 4.22 in 2000-10 and further increased to 4.86 percent in the year 2010-16. For egg production, the CAGR was computed to be 4.63 percent in 1950-60 which further increased to 5.65 percent in 2010-16. In case of wool production, the growth rate was 0.38 percent in 1950-60 which became negative in 2000-10 and then increased to 0.93 percent in 2010-16 showing very less increase over a period of time. Growth rate for meat production was calculated to be 10.99 percent in the period of 2000-10 which decreased to 7.49 percent in 2010-16. The CAGR of production of milk, eggs, and wool during the Five Year Plans is shown in Table 13. During the 5thPlan, the CAGR for production of milk, eggs, and wool was 2.91, 3.50 and 1.49 percent respectively which increased to 3.54, 4.94 and 3.03 percent respectively during the 12th plan. However, highest CAGR was observed during the 6th plan with growth rates of 6.42and 8.4 percent respectively for milk and eggs production whereas for wool highest CAGR was observed during the 12th plan.

Table 12. Compound annual growth rate (percent) of production of major livestock products in India

Year	Milk	Egg	Wool	Meat
1950-60	1.64	4.63	0.38	-
1960-70	1.15	7.91	0.34	-
1970-80	4.51	3.79	0.77	-
1980-90	5.48	7.69	2.32	-
1990-2000	4.33	4.29	2.06	-
2000-2010	4.22	5.58	-1.18	10.99
2010-2016	4.86	5.65	0.93	7.49

Table 13. Compound annual growth rate (percent) of production of milk, eggs, and wool during the Five Year Plans

Plan	Year	Milk	Eggs	Wool
5th	1975-76 to 1979-80	2.91	3.5	1.49
6th	1980-81 to 1984-85	6.42	8.4	2.67
7^{t}	1985-86 to 1989-90	4.37	7.23	1.88
8th	1992-93 to 1996-97	4.41	4.58	0.8
9th	1997-98 to 2001-02	4.08	7.29	2.2
10th	2002-03 to 2006-07	3.64	5.61	-1.77
11th	2007-08 to 2011-12	4.33	5.53	0.46
12th	2012-13 to 2016-17	3.54	4.94	3.03

CONCLUSIONS

The present study has been undertaken to provide a reflection of the status of livestock and poultry industry in India and Punjab as a subsector of agriculture. On the basis of the important findings of the study, the following conclusions are presented as below. As per 19thLivestock Census (2012), the country has a livestock population

amounting to 512 million in the world having the highest population of buffalo and goats (Government of India, 2014).Total livestock population exhibited a positive inter-census growth rate for the years 2007 and 2012. Positive growth rates were observed in case of buffalo, goat and sheep populations for all the years. Poultry population, however, exhibited positive growth rate over the years in India as well as in Punjab. Despite a minimal increase in the number of bovines in India, growth of milk production in the country was fairly high indicating significant increase in production per animal. Punjab, on the other hand, witnessed a decrease in the population of milch animals but the milk production in the state increased signaling higher productivity of milch animals. Punjab has the highest per capita availability of milk in the country and its value is far above the ICMR recommendation of 300 grams per day. Per capita availability of eggs per annum is higher in Punjab (178 eggs/annum) as compared to the national level (62 eggs/annum). Growth rates in animal numbers were modest, livestock and poultry production expanded at a faster rate than livestock population signaling significant increase in production per animal. There has been significant progress in terms of milk production, introduction of new germplasm, cooperative institutions, marketing of milk and evolving new technologies etc. Appropriate policy measures should be undertaken to strengthen animal health, improving breed of animals, veterinary services, proper marketing of livestock products and providing necessary services and information for strong livestock economy of India.

REFERENCES

Birthal, P.S., & Taneja, V.K. (2006). Livestock sector in India: Opportunities and challenges for smallholders. *Workshop on Smallholder livestock production in India: Opportunities and challenges,* January 31 to February 01, 2006. Delhi.

Borah, M., & Halim, R.A. (2014). Dynamics and performance of livestock and poultry sector in India: A temporal Analysis. *Journal of Academia and Industrial Research, 3*(1), 1-9.

Dhawan, V., & Kashish. (2016). Transforming livestock economy in India with special reference to Punjab: A review. *Economic Affairs, 61*(2), 259-271.

Dhawan, V., & Singh, J.M. (2015). Role of farm inputs in sustaining Punjab agriculture. *Indian Journal of Economics and Development,11*(1), 325-331.

Gautam, Dalal, R.S., & Pathak, V. (2010). Indian dairy sector: Time to revisit operation flood. *Livestock Science, 127*, 164-175.

Government of India. (2012). *Basic animal husbandry and fisheries statistics, 2014.* India: Ministry of Agriculture, Dept. of Animal Husbandry, Dairying and Fisheries, Krishi Bhawan, New Delhi. Retrieved from htt://dahd.nic.in/Division/statistics/animal-husbandry- statistics-division/basic-husbandry-statistics-2012.

Government of India. (2014). *Basic animal husbandry and fisheries statistics, 2014.* India: Ministry of Agriculture, Dept. of Animal Husbandry, Dairying and Fisheries, Krishi Bhawan, New Delhi. Retrieved from http://dahd.nic.in/sites/default/files/Finalpercent20BAHSpercent202014percent2011.03.2015percent20percent202.pdf.

Grover, D.K., & Kumar, S. (2012). *Economics of production, processing, and marketing of fodder crops in India*. Agro-Economic Research Centre Punjab Agricultural University, Ludhiana.

Khan, N., & Iqubal, M.A. (2008). Animal husbandry and its impact on employment generation in Aligarh district of UP (India*). African Journal of Livestock Extension Information, 6*, 20-24.

Parthasarathy, Rao, P., Birthal, P.S., Kar, D., Wickramaratne, S.H.G., & Shrestha, H.R. (2004). *Increasing livestock productivity in mixed crop-livestock systems in South Asia.* International Crops Research Institute for the Semi-Arid Tropics, Patancheru, India.

Sharma, V.P. (2004). Livestock economy of India: Current status, emerging issues, and long-term prospects. *Indian Journal of Agricultural Economics, 59*(3), 512-553.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 395-401
DOI: 10.5958/2322-0430.2018.00087.2

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Structural Changes in Dairy Sector of Karnataka State: A Regional Analysis

G. Makarabbi, G. Balaganesh, G.V. Rohith, L. Priscilla and R.S. Bhawar*

[1]*Division of Dairy Economics, Statistics,and Management, ICAR-National Dairy Research Institute, Karnal-132001*

**Corresponding author's email: makarabbigb600@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-102* *Revision Accepted: February 15, 2018*

ABSTRACT

The present study was conducted to examine the structural transformation in the dairy sector of Karnataka state based on secondary data from 1996-97 to 2011-12. The results revealed that the bovine population in the state comprised mainly of indigenous cows followed by buffaloes and crossbred cows. Across the regions, the northern region was dominated by milch indigenous cows and buffaloes, while southern region had a large number of crossbred milch animals. Similarly, the ratio of in-milk to the milch animal population for indigenous cows and buffaloes were highest in the northern region as compared to southern, and central and coastal regions. However, southern region had the highest number of crossbred cows in-milk to the milch animal population. The percent of milk production from crossbred cows was increased in all the three regions of the state over the period considered. Overall, the state has a number of indigenous cows and buffaloes which has less milk productivity than cross breds. Due to this, the cost of milk production is increasing. Exploitation of resources and increasing pressure on land is leading toa call for sustainable dairy development in the state. Therefore, in view of the future increasing demand for milk and milk products, the state government need to give significant attention for the sustenance of milk production.

Keywords
Buffaloes, CAGR, crossbred cow, indigenous cow, milk.

JEL Codes
C81, O13, O47, R11.

INTRODUCTION

Dairy Industry in India underwent significant structural changes over the years. The milk production took a giant leap from 17 million tonnes in the1950s to about 163.7 million tonnes in 2017(With 20% of agri output value, milk overtakes food grains, 2017). About 80 percent of raw milk comes from farms having only two to five cows/buffaloes (Kumar *et al*., 2013). The per capita availability of milk reached 337 g/day during the year 2015-16, which is greater than the minimum nutritional requirement of 282 g/day as recommended by WHO. The entire breakthrough in the Indian dairy sector was due to the launching of the Operation Flood Programme by the Government of India and National Dairy Development Board (NDDB) in the year 1970 (Priscilla *et al.,* 2017). This programme had objective to increase the milk production and augment the income in rural households. In India, dairying is an important secondary source of income generation for marginal farmers and landless laborers and in meeting nutritional requirements (Chand & Raju, 2008).

Dairy enterprises are very important in improving the socio-economic status of the rural poor by reducing the longstanding problems of unemployment and underemployment (Chand & Raju, 2008). The share of Gross Value Added (GVA) of the livestock sector to the agriculture sector has increased from 21.8 percent in 2011-12 to 25.7 percent in 2015-16 at Constant prices (BAHS, 2017). Value of milk produced exceeded the total value of food grains with worth ₹4,59,841 crores in 2014-15 (India leads in global milk production, 2017). Domestic demand for livestock products is rising at a faster rate and export demand is also increasing (Chand & Raju, 2008). About 1 billion poor depend on livestock for food and income in the world. The estimates of global demand for livestock products by 2050 will increase by 70 percent (FAO, 2009; Makarabbi *et al.,* 2017). The demand for livestock products was driven by population growth, urbanization and increasing individual income (Reshma & Babu, 2014).

The total number of animals in-milk in India were 116.77 million numbers. About 49 percent of milk was contributed by buffaloes followed by crossbred cows (26 percent), indigenous cows (20 percent) and others (5 percent). The number of milch animals (in-milk and dry) in cows and buffaloes has increased of 6.75 percent with population from 111.09 million in 2007 to 118.59 million in 2012 (Department of Animal Husbandry Dairying and Fisheries, 2012). During 2015-16, Karnataka ranked at 11th position in India in milk production by producing 6.34 MT of milk with a per capita availability of 282 g/day. In the state, about 74 percent of the families were dependent on dairying alone (Government of Karnataka, 2016). In terms of cattle and buffalo population, Karnataka holds the 9th position in the country accounting for4.3 percent of the total population (Department of Animal Husbandry Dairying and Fisheries, 2012). Currently, indigenous cow and buffalo population registered an annual decline of 4.5, and 4.3 percent, respectively between 2007 and 2012 census periods, while that of crossbred cow population increased by 5.8 percent. Mainly farmers in the districts of Bangalore, Kolar, Chikkaballapura, Dakshina Kannada, Chamarajanagar, Mandya, Ramanagara, *etc*. have more than 40 percent crossbred animals in their herds, which have great influence on generating substantial income.

Despite significant changes in the milch animal composition in favor of crossbred cows, the productivity of dairy animals continues to remain very low and milk marketing system is still traditional (Sarker & Ghosh, 2008, 2010). This paper provides an insight into how the composition of the bovine population has changed over time and also focusses on the facets of milk production in Karnataka state. This will help in developing strategic interventions for raising milk yield and ensuring sustainable growth of the dairy sector. Based on this, the paper looks into the process of structural transformation of dairy sector in terms of trends in milk production and sources of growth therein.

DATA AND METHODOLOGY

Data

For the present study, data were compiled from various secondary sources such as Basic Animal Husbandry Statistics, published by the Department of Animal Husbandry, Dairying and Fisheries of the Ministry of Agriculture, Government of India (GoI) and Dairying in Karnataka: A Statistical Profile 2015 by National Dairy Development Board. Data covered information on animal population, milch animal population, in-milk animal population, milk production, *etc.*

METHODOLOGY

Kumari *et al.* (2017) have used Compound Annual Growth Rate (CAGR) analysis to compute the structural changes in milk production of Uttar Pradesh. In the present study, the CAGR was estimated for the variables bovine population, the ratio of in-milk to milch animals and milk production.

$$Y_t \quad Y_O \; 1 \quad r^{\;t} \qquad \text{..... (1)}$$

Taking log on both sides and transforming to logarithmic form:

$$\ln Y_t \quad \ln Y_O \quad t \ln 1 \quad r \qquad \text{..... (2)}$$

Where,

Y_t= Variable for which growth is calculated.
r = Compound growth rate.
Ln= Natural logarithm.

Take, $\ln Y_0 = \beta_1$ and $\ln(1+r) = \beta_2$
Then, equation (2) becomes,

$$\ln Y_t \quad \beta_1 \quad \beta_2 t \qquad \text{..... (3)}$$

Here, β_1 and β_2 are estimated by Ordinary Least Square (OLS) method and the CAGR is estimated as,

$$r \quad (\text{antilog}\,\beta_2 \quad 1) \quad 100$$

Different Regions of Karnataka

Karnataka is divided into ten agro-climatic zones and roughly three different regions based on rainfall, topography, humidity, socio-economic conditions *etc*. The districts coming under different regions are mentioned in Table 1.

RESULTS AND DISCUSSION

Bovine Population

The bovine population comprises of indigenous cows, crossbred cows, and buffaloes. Table 2 perusals the composition of the bovine population in different regions of Karnataka state. The overall state had a large number of indigenous cows and buffaloes with a population of 95.41 lakh and 43.66 lakh, respectively during the year 1996-97. Currently, the rearing of indigenous cows and buffaloes decreased by 4.3 and 4.7 percent, respectively (19th Livestock Census). In recent times, the dairy farmers had shown interest in the adoption of crossbred cows. Over the past years, the population of crossbred cows has increased from 12.93 lakh in 1996-97 to 29.14 lakh in 2011-12. The crossbred animal population increased by 5.7 percent in 2012 as compared to 2007 (19th Livestock Census).

In the northern region of the state, the population of the indigenous cow as a percent of the total bovine population was 54 percent during 2011-12 as compared to 43 percentin 1996-97. Similarly, for buffaloes also it was found to be increased to 63 percent in 2011-12 from 52 percent in 1996-97 in the northern region. While the central and coastal, and southern region showed the slightly decreased population in both indigenous cows and buffaloes. In the state, about 62 percent of crossbred cows distributed in the southern region and 20 percent in the central and coastal region and rest 18 percent in the northern region. From the Table 2, the consistent increase in crossbred cow population in the southern region is observed. While in case of northern and central and

coastal region the population of local cows and buffaloes were found to be increasing consistently.

Growth Rate of Bovine Population

The growth rate of bovine population is presented in Table 3. The growth rate of indigenous cows and buffaloes showed a decreasing trend in all the three regions. The crossbred cow's population growth rate was impressive in three regions with 25 percent in the northern region, 32.05 percent in the central and coastal region and 33.75 percent in southern region during 1996-97 to 2002-03. During 2006-07 to 2011-12, the growth rate of crossbred cows was decreased in the central and coastal region but in other regions such as northern and southern showed consistently increased growth rate. Therefore, it is observed that the popularity of adoption of crossbred cows in these regions has increased.

Milch Animal Population

Milch animals comprise both in-milk and dry animals. The region-wise composition of the milch animal population in Karnataka state is shown in Table 3. The population of indigenous milch cows decreased from 29.79 lakh in 1996-97 to 21.99 lakh in 2011-12 and incase of buffaloes, it was decreased to 18.88 lakh in 2011-12 from 23.37 lakh in 1996-97. While crossbred milch animals population showed an increasing trend from 6.89 lakh in 1996-97 to 17.21 lakh in 2011-12. Out of the three regions, southern region had the maximum number of crossbred milch animals (11.34 lakh) while northern and central and coastal region had 2.7 lakh and 3.94 lakh crossbred milch animal population, respectively in the year 2011-12. The northern region has a large number of milch buffaloes with 11.86 lakh numbers in 2011-12 and

Table 1. Districts comes under different regions

Region	Districts
Northern region	Dharwad, Haveri, Gadag, Belagavi, Bagalkot, Vijayapura, Bellary, Koppal, Raichur, Klaburagi (Includes Yadgir), Bidar, Uttara Kannada
Central and Coastal Region	Shivamogga, Davanagere, Chitradurga, Chikkamagalur, Udupi, Dakshina Kannada
Southern Region	Bengaluru Urban, Bengaluru Rural (Includes Ramanagar), Tumakur, Kolar (Includes Chikkaballapur), Hasan, Kodagu, Mysuru, Mandya and Chamarajanagar

Table 2. Region-wise composition of bovine population in Karnataka

(In '000)

Region	Local cow				Crossbred cow				Buffalo			
	1996-97	2002-03	2006-07	2011-12	1996-97	2002-03	2006-07	2011-12	1996-97	2002-03	2006-07	2011-12
Northern	4105	3738	4102	3558	274	252	364	510	2278	2295	2674	2204
Central and Coastal	2151	1865	1905	1432	257	381	513	588	877	773	748	562
Southern	3285	2332	2302	1615	762	973	1317	1816	1211	932	903	705
Karnataka State	9541	7935	8309	6605	1293	1606	2194	2914	4366	4000	4325	3471
Composition (In %)												
Northern	43	47	49	54	21	16	17	18	52	57	62	63
Central and Coastal	23	24	23	22	20	24	23	20	20	19	17	16
Southern	34	29	28	24	59	61	60	62	28	23	21	20

Table 3. Region-wise annual compound growth rate of bovine population in Karnataka

(In '000)

Region	Local cow			Crossbred cow			Buffalo		
	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-12	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-12
Northern	-3.31	-2.44	-19.29	25.00	42.00	43.03	0.54	-2.00	-17.58
Central and Coastal	-11.30	-12.37	-16.78	32.05	24.23	14.62	-12.78	-14.73	-24.87
Southern	-19.29	-16.78	-29.84	33.75	36.62	37.89	-15.25	-13.03	-21.93

southern and central and coastal region with 4.14 lakh and 2.88 lakh milch buffaloes, respectively.

During the year 2011-12, the indigenous milch cow population in the northern region was 50 percent of that in total indigenous milch population, while and remaining 23 percent was in the central and coastal region and 27 percent in the southern region. During the year 2011-12, the crossbred milch animal population was highest in the southern region with 66, and 16 percent in the northern region and 18 percent in central and coastal regions. In total crossbred milch animal population, the northern region has 16percent of the crossbred milch animal population during 2011-12 and which was 19percentin 1996-97. While the buffaloes milch animal population was highest in the northern region with 63 and 22 percent in the southern region and rest 15 percent in the central and coastal region. In the southern region, the number of milch population was increased consistently over the years and in other two regions *i.e* northern and central it was shown milch animal population was decreased.

Growth Rate of Milch Animals

The growth rate of milch animal population is presented in Table 5. The growth rate of indigenous cows and buffaloes milch animal population was found to be decreased in three regions. The crossbred milch animal population was increased in both southern and northern region. The CAGR of the crossbred milch animal population was increased significantly by 51.69 percent in 2006-07 to 2011-12 in the northern region, while it was 39.83 in the southern region. In the central and coastal region, the growth rate of crossbred milch animal population was found to be decreased by 5.44 percent in 2002-03 to 2011-12.

In-milk to Milch Animal Population

Here in-milk to milch animals means animals which are in milking except dry animals are called in-milk animals. Table 6 shows the in-milk to the milch animal population in different regions of Karnataka. From the Table 6, it observed that the over the years indigenous cows and buffaloes in-milk to milch animal population was decreased in the state. During 2011-12, the state has 12.92 lakh, 13.06 lakh and 12.96 lakh of indigenous, crossbred and buffaloes in-milk to milch animal population, respectively. In northern and central and coastal region in-milk to the milch animal population of indigenous cows and buffaloes has increased from 1996-97 to 2002-03 and again it was decreased in 2006-07 to 2011-12. But, in the case of the southern region in-milk to the milch animal population of crossbred cows increased consistently from the year 1996-97 to 2011-12. Overall the number of in-milk to the milch animal population of crossbred cows was increased in the state over the past years.

In the three regions, the percent of the in-milk to milch animal population was different. In both central and

Table 4. Region-wise composition of milch animals in Karnataka

(In '000)

Region	Local cow				Crossbred cow				Buffalo			
	1996-97	2002-03	2006-07	2011-12	1996-97	2002-03	2006-07	2011-12	1996-97	2002-03	2006-07	2011-12
Northern	1129	1065	1196	1097	128	123	178	270	1237	1270	1452	1186
Central and Coastal	709	616	640	505	126	194	259	317	394	379	373	288
Southern	1141	819	816	594	435	582	811	1134	706	551	536	414
Karnataka State	2979	2500	2652	2199	689	899	1248	1721	2337	2200	2361	1888
Composition (%)												
Northern	38	43	45	50	19	14	14	16	53	58	61	63
Central and Coastal	24	25	24	23	18	22	21	18	17	17	16	15
Southern	38	33	31	27	63	65	65	66	30	25	23	22

Table 5. Region-wise annual compound growth rate of milch animals in Karnataka

(%)

Region	Local cow			Crossbred cow			Buffalo		
	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-12	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-12	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-12
Northern	0.30	1.49	-8.28	29.81	48.16	51.69	0.08	-3.36	-18.32
Central and Coastal	-9.33	-9.46	-21.09	35.76	27.83	22.39	-9.12	-12.83	-22.79
Southern	-17.82	-14-84	-27.21	37.80	39.59	39.83	-15.03	-13.32	-22.76

coastal and southern region, the indigenous cow in-milk to milch population were decreased consistently. Similarly, in case of buffaloes, in-milk to milch animals populations decreased over the past years in both central and coastal region and southern region. While the in-milk to milch crossbred animal population was decreased consistently in both central and coastal and northern region, while in the southern region it was increased consistently over the past years. During 2011-12 the northern region has 53 percent of indigenous in-milk to the milch animal population of the state, while the southern and central and coastal have 25, and 22 percent, respectively. Also, northern region has highest buffaloes in- milk to a milch animal population with 63 and 23 percent in the southern region and 14 percent in the central and coastal region. As already shown in the bovine population that southern region has a number crossbred cows population and also this region has highest crossbred cows in-milk to a milch population with 66 and 15 percent in the northern region and 18 percent in the central and coastal region.

Growth Rate of In-milk to Milch Animals Population

The CAGR of in-milk to milch animal population is presented in Table 7. The annual growth rate of indigenous cow and buffaloes in-milk to milch animal population was decreased from past periods in all the three regions of the state. The crossbred animal in-milk to milch animal population was shown the significant growth rate in all the three regions. During 2006-07 to 2011-12 the growth rate of the crossbred animal in-milk to milch animal population was highest with 45.39 percent as compared to southern (37.17 percent) and central and coastal region (21.24 percent). In the central and coastal region, the growth rate of the crossbred animal in-milk to milch population was decreased by 6.44 percent in the year 2006-07 to 2011-12.

Milk Production

The region-wise bovine milk production in Karnataka is presented in **Ta**ble 8. Over the past years, the milk production contributed by the indigenous cow and crossbred cow in total milk production was increased. While the milk contributed by the Buffaloes in total milk production was decreased to 13.87 MT in 2006-07 from 18.28 MT in 1996-97. In the northern region, the indigenous cow milk production decreased from 6.37 MT in 1996-97 to 6.25 MT in 2011-12. Similarly, in the southern region, it was decreased from 4.82 MT in 1996-97 to 3.32 MT in 2011-12. While in southern region indigenous cow milk production was increased to 10.88 MT in 2011-12 from 10.24 MT in 1996-97. In state crossbred cow milk production in total milk production was increased from the period 1996-97 to 2011-12 were 1.18 MT to 3.57 MT in the northern region, 2.82 MT to 4.64 MT in the central and coastal region and 11.46 MT to 20.47 MT in the southern region.

In terms of region-wise milk contribution by different

Table 6. Region-wise in-milk animals to milch animals population in Karnataka

(In '000)

Region	Local cow				Crossbred cow				Buffalo			
	1996-97	2002-03	2006-07	2011-12	1996-97	2002-03	2006-07	2011-12	1996-97	2002-03	2006-07	2011-12
Northern	742	655	764	679	94	96	141	205	869	857	998	818
Central and Coastal	448	367	386	290	95	144	193	234	250	223	227	181
Southern	570	386	402	323	337	446	623	867	478	367	360	297
Karnataka State	1760	1408	1552	1292	526	686	957	1306	1597	1447	1585	1296
Composition (In %)												
Northern	42	47	49	53	18	14	15	15	54	59	62	63
Central and Coastal	25	26	25	22	18	21	20	18	16	15	14	14
Southern	32	27	26	25	64	65	65	66	30	25	23	23

Table 7. Region-wise annual compound growth rate of in-milk animals to milch animal growth

(In %)

Region	Local cow			Crossbred cow			Buffalo		
	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-12	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-12	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-12
Northern	-1.12	-44.80	-11.13	31.31	46.13	45.39	-0.29	-2.30	-18.04
Central and Coastal	-11.79	-11.11	-19.65	34.95	27.48	21.24	-9.07	-9.91	-20.26
Southern	-15.32	-8.52	-19.65	37.29	39.43	37.17	-13.47	-10.04	-17.50

Table 8. Region-wise bovine milk production in Karnataka

(In '000 MT)

Region	Local cow				Crossbred cow				Buffalo			
	1996-97	2002-03	2006-07	2011-12	1996-97	2002-03	2006-07	2011-12	1996-97	2002-03	2006-07	2011-12
Northern	637	504	552	625	118	186	238	357	1024	872	846	1088
Central and Coastal	255	251	292	305	231	282	309	464	322	177	212	220
Southern	553	288	356	304	796	930	1101	1226	482	301	329	332
Karnataka State	1445	1043	1200	1234	1145	1398	1648	2047	1828	1350	1387	1640
Composition (In %)												
Northern	44	48	46	50	10	13	14	17	56	65	61	66
Central and Coastal	18	24	24	25	20	20	19	23	18	13	15	14
Southern	38	28	30	25	70	67	67	60	26	22	24	20

Table 9. Region-wise compound annual growth rate of bovine milk production in Karnataka

(%)

Region	Local cow			Crossbred cow			Buffalo		
	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-12	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-12	1996-97 to 2002-03	2002-03 to 2006-07	2006-07 to 2011-12
Northern	0.34	11.36	13.22	42.87	38.54	50.00	1.53	11.70	28.61
Central and Coastal	7.13	10.23	4.45	24.41	28.27	50.16	-9.17	11.49	3.77
Southern	-14.64	2.74	-14.61	15.77	14.82	11.35	-9.78	5.02	0.91

species, it was found that the crossbred cows contribute the highest in total milk contribution. During 2011-12, the northern region contributed 14 percent, central and coastal region, 23 and 60 percent by southern region as compared to 70, 20, and 10 percent by southern, central and coastal and northern region, respectively in total crossbred cow milk production. In the case of the indigenous cow 50 percent of milk was contributed by the northern region and rest 50 percent equally distributed by the central and coastal and southern region in 2011-12 and it was 44, 38, and 18 percent of milk was contributed by the northern, southern and central and coastal regions in 1966-97. Similarly, in case of buffaloes milk contribution, the northern region contributes about 66 percent of milk followed by 20 percent by southern region and 14 percent by the central and coastal region, while it was 65, 20, and 14percent by northern region, southern central and coastal region in the year 1996-97. Overall it shows that northern region has highest milk contribution in both indigenous cow and buffaloes and southern region has highest milk contribution in crossbred cows.

Growth Rate of Milk Production

The region-wise annual growth rate of bovine milk production in Karnataka shown in Table 9. The growth rate of milk production in the northern region by indigenous cows has increased 13.22 percent in the year 2006-07 to 2011-12 when compared to 11.36 in 2002-03 to 2006-07. While in case of both central and coastal and southern region the growth rate of milk production by local cow and buffaloes decreased. Crossbred cow milk growth rate was highest in northern region when compared to and central and coastal region. The growth rate of milk production was 50.16 percent in 2006-07 to 2011-12 in central and coastal region which is higher than 50.16 and 11.35 percent northern and southern region, respectively.

CONCLUSIONS

The present study revealed that the state bovine population had a large number of indigenous cows followed by buffaloes and crossbred cows. During 2011-12, the northern region was dominated by an indigenous cow and buffaloes milch animals, while southern region had a higher number of crossbred milch animals. Similarly, the in-milk to the milch animal population for indigenous cows and buffaloes were highest in the northern region as compared to southern and central and coastal region. In the state, percent of milk production was highest from crossbred animals followed by buffaloes and indigenous cows. During 2011-12, the southern region produced more quantity of milk from crossbred cows while the northern region produced the highest percent of milk from buffaloes followed by indigenous cows and crossbred cows. Overall, the state had a large number of indigenous cows and buffaloes with less milk production. Due to this, the input cost of milk production is increasing. There is also over-exploitation of resources, increasing pressure on land, *etc.* leading to a call for sustainable dairy development in the state. Therefore, in view of the future increased demand for

milk and milk products, state government need to give significant attention for the sustenance of milk production.

REFERENCES

Chand, R., & Raju, S.S. (2008). Livestock sector composition and factors affecting its growth, *Indian Journal of Agricultural Economics*, *63*(2), 198-210.

Department of Animal Husbandry Dairying and Fisheries (2012). *Livestock census (1997-2012)*. Department of Animal Husbandry Dairying and Fisheries, Ministry of Agriculture, Government of India, New Delhi.

FAO. (2009). *High-level expert forum-How to feed the world in 2050.* Food and Agriculture Organization Office of the Director, Agricultural Development Economics Division Economic and Social Development Department Viale Delle Terme di Caracalla, Rome, Italy.

Government of India. (2017). *Basic animal husbandry and statistics.* Department of Animal Husbandry, Dairying, and Fisheries-2017, Ministry of Agriculture, Government of India, New Delhi.

Government of Karnataka (GoK). (2016). *Evaluation of Milk Incentive Scheme.* Department of AH & VS, Bengaluru, Karnataka State. Retrieved from http://kea.karnataka.gov.in/sites/default/files/Evaluation%20of%20the%20programme%20Milk%20Incentive%20Scheme.pdf

India leads in global milk production. (2017, December 27).. *The Hindu*. Retrieved from http://www.thehindu.com/news/national/india-leads-in-global-milk-production/article22320382.ece.

Kumar, A., Parappurathu, S., & Joshi, P.K. (2013). Structural transformation in dairy sector of India, *Agricultural Economics Research Review 26*(2), 209-219.

Makarabbi, G., Raj, L., & Balaganesh, G. (2017). Study on organized and un-organized milk marketing channels in India. *Trends in Biosciences*, *10*(21), 4093-4096.

National Dairy Development Board (NDDB). (2015). *Dairying in Karnataka-A statistical profile 2015.* Anand, Gujarat.

Priscilla, L., Chauhan, A.K., Lalrisangpuii., Balakrishnan, A., & Makarabbi, G. (2017). Participation behaviour of Dairy Farmers in Dairy Co-operative Societies in Manipur: A Double Hurdle Approach, *Indian Journal of Agricultural Economics, 72*(3), 420-428.

Reshma, M., & Babu, A.S. (2014). Demand and supply of milk in Karnataka by 2021, are we heading towards a crisis? *International Journal of Innovative Research in Science, Engineering, and Technology*, *3*(4), 11117-11123.

Sarker, D., & Ghosh, B.K. (2010). Constraints of milk production: A study on cooperative and non-cooperative dairy farms in West Bengal. *Agricultural Economics Research Review, 23*(2): 303-314.

Sarker, D., & Ghosh, B.K. (2008). Economics of milk production in West Bengal: Evidence from cooperative and non-cooperative farms. *Journal of Economics and Business*, *11*(1 & 2), 132-152.

With 20% of agri output value, milk overtakes foodgrains. (2017, October 23). *The Indian Express*. Retrieved from http://indianexpress.com/article/india/with-20-of-agriculture-output-value-milk-overtakes-foodgrains-4901882/.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 402-409
DOI: 10.5958/2322-0430.2018.00088.4

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Potential Impact of Dairy Cooperatives on Sustainable Milk Production: Evidence from Gujarat, India

Darshnaben Mahida[1], Sendhil R.[2], Smita Sirohi[1], B.S. Chandel[1], Ponnusamy K.[1] and Gopal Sankhala[1]*

[1]*ICAR-National Dairy Research Institute, Karnal-132001*
[2]*ICAR-Indian Institute of Wheat and Barley Research, Karnal-132001*

[*]*Corresponding author's email: darshnapmahida93@gmail.com*

Received: January 16, 2018 *Manuscript Number: NS-18-113* *Revision Accepted: February 18, 2018*

ABSTRACT

Dairying has been a prominent supplementary enterprise and regular source of income to the farmers. Indian dairy sector has progressed commendably well with the seven-fold increase in milk production since independence, but progress in terms of yield per animal is still low which is quite unsustainable. Literature suggests two approaches for productivity growth viz., through technological progress and improved efficiency. The present study is an attempt to determine the factors affecting the technical efficiency of dairy farmers in Gujarat state with a special emphasis on the role of milk cooperatives. Multiple regression analysis and regression tree approach were used for arriving valid conclusions. Results indicated that socio-economic factors i.e. membership in the dairy cooperative society, non-farm annual income, access to information, and herd size significantly influenced the technical efficiency of farmers. Dairy cooperatives provide several inputs in the form of dairying resources as well as technical information to the farmers which significantly influenced their efficiency. The study concludes with policy prescriptions for enhancing milk production and shift towards sustainable dairying.

Keywords
Gujarat, regression tree, sustainable dairying, technical efficiency.

JEL Codes
Q01, Q12, Q13.

INTRODUCTION

Crops and livestock farming are essential attributes of Indian agriculture and pursued to complement each other. India, despite being the world's largest milk producer with around 155 million tonnes produced in the year 2015-16 (National Dairy Development Board, 2016), the milk productivity remains lowest than most of the leading countries of the world. Indian dairy industry is characteristically highly fragmented. It is majorly dominated by the unorganized sector. The organized dairy sector accounts for the 80 percent of the revenue from the sector, because of their strong, efficient and favorable raw material sourcing model. However, in India, it accounts for only 20 percent of the total milk marketed (Kulkarni & Jain, 2015). Dairy cooperatives in India came into existence from 1946 onwards by the establishment of the first farmers' integrated dairy cooperative popularly known as 'AMUL (Anand Milk Union Limited)' in Anand town (now district) of Kaira District of Gujarat. It was brought forward to fight against the extreme exploitation of farmers by the private traders.

The highest milk production in the country mainly accounts to the largest cattle population rather than productivity. Productivity growth can be the key factor for sustainable milk production. Literature suggests two pathways to enhance the productivity growth, *viz.*, through technological progress and technical efficiency improvement (Karanja *et al.*, 2012). Dairy cooperatives provide an organized network of milk marketing along with crucial technical inputs like provision of artificial insemination, health services, and feed inputs which influence the farm level resource use efficiency. Dairy cooperatives also facilitate processing of milk to produce a value-added product. Many rural people still associated

with the unorganized sector which does not provide them any sustainable benefits or social security.

Gujarat has been a pioneer in the dairy cooperative movement where dairy industry is more organized and efficient compared to other states. It is one of the largest milk producing state in the country with the contribution of 7.24 percent share to the total milk production (DOAH, 2015-16). About 42 percent of the total households in the state is engaged in dairy and animal husbandry activities, which serve as a primary or secondary source of income. Despite most of the districts having active dairy cooperative societies, there exist variation in the technical efficiencies of farmers across regions as it largely depends on the several factors like quality of milch animals, quantity and quality of fodder available (Saravanakumar, 2005), ease of getting veterinary and extension services, farm size, milk marketing system and many others (Ojo, 2012). The current study is focused to identify the determinants of technical efficiency of the dairy farmers, so the policies or interventions will help for enhancing milk production and long-term sustenance of the dairy sector.

DATA AND METHODOLOGY

All the districts in Gujarat state were scaled on dairy development index (DDI) using the principal components analysis as outlined in Mahida & Sendhil (2017). The DDI was constructed by considering various aspects of dairying like resource availability, infrastructure and veterinary facilities, and milking animals and their yields and were categorized into high, medium and low based on the dairy development index. For analyzing the technical efficiency and its determinants, primary data were collected from three districts each having a different level of dairy development. Three districts namely; Anand from high, Bharuch from moderate and Tapi from low dairy development categories from which a sample of total 180 dairy farmers was selected. From each district 30 cooperative member and 30 non-member dairy farmers were selected. The data were collected through personal interview method with the help of a well-structured, comprehensive and pretested interview schedule.

Technical Efficiency of Dairy Farmers and its Determinants

Technical efficiency is the ability of a farmer to produce maximum possible output at given production technology and level of inputs. A non-parametric approach, that is, Data Envelopment Analysis (DEA) has been used to estimate the technical efficiency of the cooperative member and non-member dairy farmers (Chandrasekar *et al.*, 2017). Technical efficiency is very much influenced by different socio-economic factors. Therefore, to know the determinants of technical efficiency, the respondent's efficiency score was regressed against different socio-economic variables (Table 1). To indicate the possible effects of farm characteristics on the efficiency of milk production, the socio-economic variables were included in the following model to isolate the effect of the same (Ajibefun *et al*., 1996). Multiple linear regression models have been employed against the Tobit model to identify the determinants of technical efficiency. Tobit model generally has the truncated or censored dependent variable depending on the available information, whereas, in our case, the dependent variable has a range

Table 1. Variables considered in the study

Variables	Description	Measurement
Herd size	Number of animals owned by farmer	Measured as standard animal units (SAUs) (Sirohi *et al*., 2015)
Area under fodder crops	Total area used for fodder purpose	Hectares (ha)
Distance from village dairy cooperative society	Distance that farmers have to travel to sell the milk at milk collection center	Kilometers (km)
Non-farm income	Amount of income generated by family from occupations other than dairying	Lakh
Access to information	Sources of information considered were extension agent, KVK, agricultural college/university, progressive farmers, private commercial agent, Multimedia, veterinary department, NGO and District milk	Index score measured dividing obtained score for each farmer by the maximum score for accessing all information sources (Ponnusamy, 2006)
Farming experience	Experience of farmer specifically in dairying	Number of years
Cooperative membership	Whether farmer has participation in dairy cooperative or not	1 = Member 0 = Non-member
Location dummy	Effect of farmer's location being in moderately developed district	1= Bharuch 0 = Otherwise
	Effect of farmer's location being in low developed district	1= Tapi 0 = Otherwise

from 0 to 100 and for each respondent/farm the relative efficiency score was calculated after applying the DEA (Chandrasekar *et al*., 2017). Hence, in the present study application of multiple linear regression models was more appropriate and the functional form is given as follows.

$TE_j = (\beta_0, \beta_1 X_1, \beta_2 X_2 \ldots \beta_n X_n)$

where TE_j is the technical efficiency of jth farmer

β_0 is the intercept

β_1 to β_n are the partial regression coefficients

X_1 to X_n are the explanatory variables including dummy

Regression tree analysis has been used to identify the sequence of variables on the basis of the model significance of explanatory variables to the independent variable. It is a non-parametric approach which explains the response of a dependent variable against independent continuous or categorical variables. Employing a variance-minimizing algorithm, the analysis repeatedly partitions the dataset to determine the homogenous sub-groups based on the given partition criteria (Zheng *et al.*, 2009). The main objective of the regression tree analysis is to derive a structure, according to the independent variable(s), by producing the best possible homogenous nodes (Larsen and Speckman, 2004). In the process, the dependent variable data gets split into a series of left and right child nodes which is being derived from the primary nodes. When the split is terminated, child nodes are called as terminal nodes. The splitting process terminates when the explanatory variables do not provide any further information. The tree will keep selecting explanatory variables to sub-divide the given observations till a point that can be justified statistically leading to a large number of terminal nodes (Cak *et al.,* 2013).

RESULTS AND DISCUSSION

Socio-economic Profile: Socio-economic characteristics of the farmers play a major role in decision making which directly or indirectly influence their efficiency and profitability. The findings indicated that the average age of member farmer was smaller but was more experienced and educated than non-members (Table 2). Average operation land holding was higher for the member, but the area allocated for fodder purpose was higher for non-member farmers. Average herd size and yield for all local, crossbred cow and buffalo were higher for member farmer. Farmer's access to information was higher for member farmer while the distance from dairy cooperative was little higher for non-member.

Table 2. Socio-economic profile of farmers

Particular	Member (n_1=90)	Non-member (n_1=90)
Farmer characteristics		
Age of farmer (years)	43.27	44.32
Mean education score	5.09	4.72
Farming experience (years)	16.51	14.6
Farm characteristics		
Average operational land holding (ha)	1.82	1.42
Average area under fodder crops (ha)	0.23	0.24
Average herd size (SAUs)	5.43	4.08
Average daily milk yield (liter/day)		
a. Local cow	4.61	3.58
b. Crossbred cow	10.95	10.85
c. Buffalo	5.61	5.06
Institutional support structure		
Access to information score	0.66	0.60
Distance from dairy cooperative (km)	0.94	1.09

Table 3. Distribution of farmers across technical efficiency ranges

Technical efficiency (%)	Member	Non-member
Upto 49.99	3 (3.33)	5 (5.56)
50.00 - 59.99	7 (7.78)	20 (22.22)
60.00 - 69.99	13 (14.44)	16 (17.78)
70.00 - 79.99	14 (15.56)	14 (15.56)
80.00 - 89.99	10 (11.11)	5 (5.56)
90.00 - 100.00	43 (47.78)	30 (33.33)
Total	90 (100.00)	90 (100.00)
Mean Score (%)	83.27	75.31

Figures within parenthesis indicate the percent of the total.

Technical Efficiency: The technical efficiency analysis results showed that the member farmers were more efficient with a mean efficiency score of 83.27 percent than the non-member (75.31 percent). Table 3 shows the frequency of member and non-member farmers in each range of technical efficiency. It revealed that around 48 percent of the member farmers were found in the upper technical efficiency range while that of non-members were found to be around 33 percent only. Among the efficiency score intervals, members of dairy cooperative societies were found to be minimum in less than 49.99 percent score whereas, it was 0 - 49.99 percent and 80.00 - 89.99 percent score range for non-members. The overused resources were found to be the green and dry fodder in general while in highly developed districts concentrates were used more inefficiently. Thus, overuse of this resources can be reduced which will help in long-term to satisfy the need of increasing dairy animals with the burgeoning human population to fulfill the human need for milk and milk products.

Determinants of technical efficiency in milk production – The role of cooperatives: The variation in the farmer's technical efficiency can be attributed to their

management practices and their socio-economic characteristics. The inefficiencies existing at present can be improved by assessing the factors influencing their technical efficiency. Hence, it is very important to investigate those factors. The Table 4 indicates that the socio-economic factors *i.e.* membership in the dairy cooperative society, non-farm annual income, access to information and herd size were significantly influencing the technical efficiency of farmers. Among all the significant variables, membership in the dairy cooperative society, non-farm income and access to information has a positive influence while the herd size had a negative effect.

Membership in dairy cooperatives coefficient indicated that if the farmer becomes a member of the dairy cooperative society, his/her efficiency increases by around four percent. This shows that the provision of technical inputs like concentrates, minerals, and supplements; and services like artificial insemination, animal health care at a lower rate than the market and free advisory services encourages farmers to improve dairy practices and make a profit. Cooperatives also provide an annual or half-yearly bonus to the participating farmers which are a fixed percentage of the value of milk marketed by a farmer.

The coefficient of non-farm income showed that *ceteris paribus,* increase in the non-farm income by one unit will increase the farmer's efficiency by around six percent. Similarly, the coefficient of access to information indicated that with an increase in access to information score by a unit, the efficiency score will increase by 49 percent. The coefficient of herd size showed that an increase in herd size by one SAU will make the farmer inefficient by 0.73 percent. This shows that the availability of non-farm income to the farmers provide more resources to assist the farmer for better access and allocate the dairy inputs. Similarly, the access to information also has a positive impact on farmer's efficiency as the farmer remain better equipped with the modern technologies and dairying practices which help farmers to manage farm efficiently. The above findings were found to be similar to the study done by Ojo (2012).

The herd size had negative effect implying that as herd size increases, the farmers cannot manage farms efficiently as he/she has to perform other works simultaneously. The partial regression coefficients of farming experience showed that as the experience of the farmer increases, he/she becomes more efficient. This is because the experienced farmer has more practical knowledge of dairying activities. A more experienced farmer can use balanced nutrition and better management practices which he learns through his lifetime experiences corroborating the findings by Mor and Sharma (2012). The partial coefficients of location dummy for moderately and low developed district, namely, Bharuch and Tapi were positive and significant indicating that if the Anand farmer has been in Bharuch or Tapi district, then his/her efficiency will increase. The result showed a contradiction to our assumption that the farmers in the highly developed district are more efficient than that of the low developed district. The reason could be due to the higher inefficiency of non-member farmers of Anand than all the farmers of other districts regardless of member or non-member category because the Anand non-members comprise a large proportion of small and/or medium farmers and they mainly rear buffaloes to fulfill their milk need for home consumption. Also, they were not having more contact with dairy cooperatives or extension agents.

Regression tree analysis was done to get a visual structure which provides information on the importance of factors affecting the technical efficiency. The regression tree (Figure 1) shows the order of importance of variables influencing the technical efficiency of farmers in Gujarat state. The regression tree structure has

Table 4. Estimates of regression for factors influencing technical efficiency

Variables	Coefficients	Standard errors
Constant	34.72	-3.05
X_1 = Herd size (SAUs)	-0.74**	-0.26
X_2 = Area under fodder crop (hectares)	7.99	-5.53
X_3 = Distance from village dairy cooperative society (km)	-1.99	-1.29
X_4 = Non-farm annual income (lakh)	6.02**	-1.91
X_5 = Access to information (index score)	49.03**	-5.37
X_6 = Farming experience (years)	0.15	-0.08
X_7 = Membership [1= Member & 0 = Otherwise]	4.19*	-1.47
X_8 = Location dummy [1= Bharuch & 0 = Otherwise]	5.05**	-1.62
X_9 = Location dummy [1= Tapi & 0 = Otherwise]	3.59**	-1.69
$\overline{R}^2$	0.78**	
F statistics	72.50	
Number of observations	180	

significant (p<0.05) **significant (p<0.01).

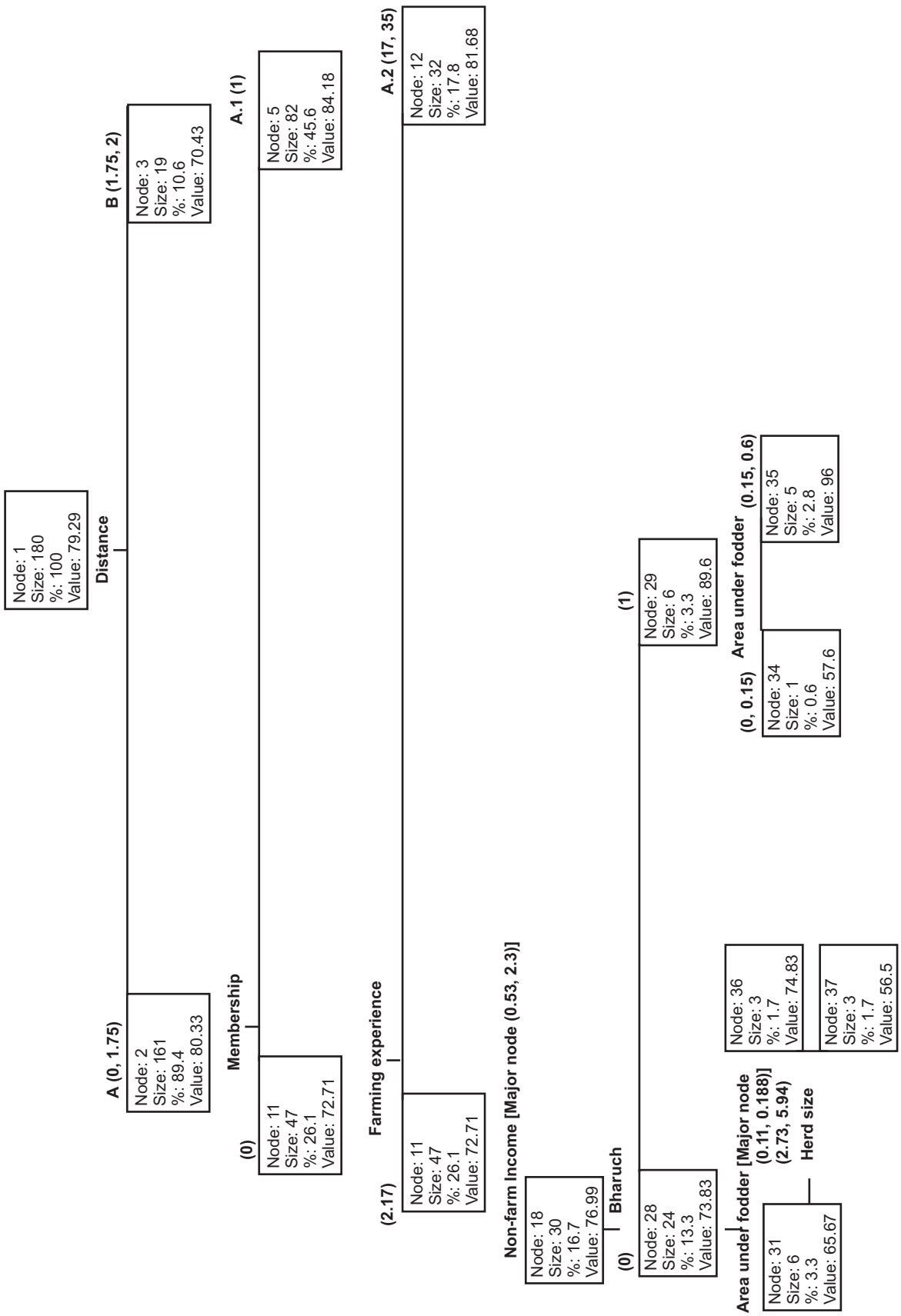
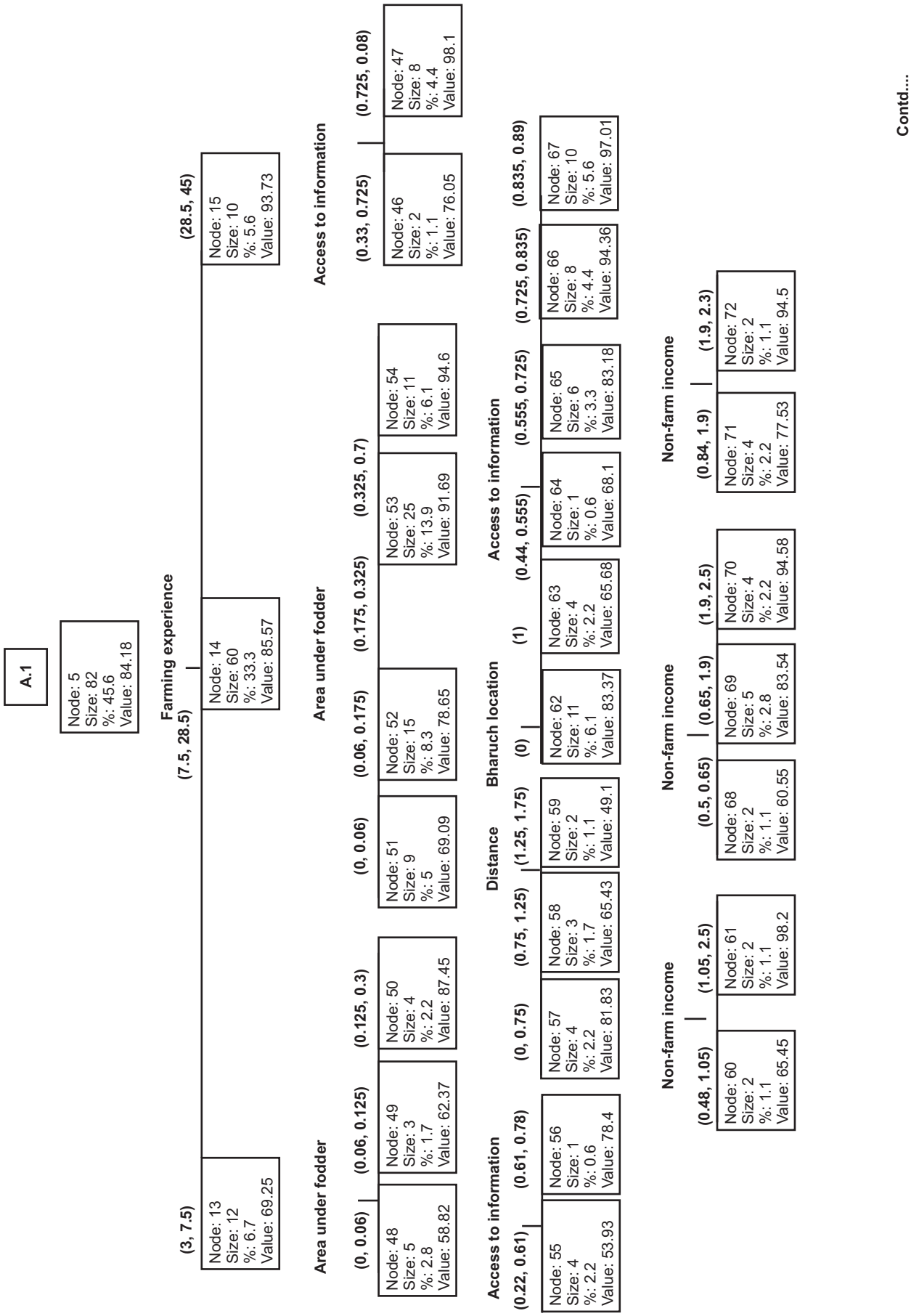
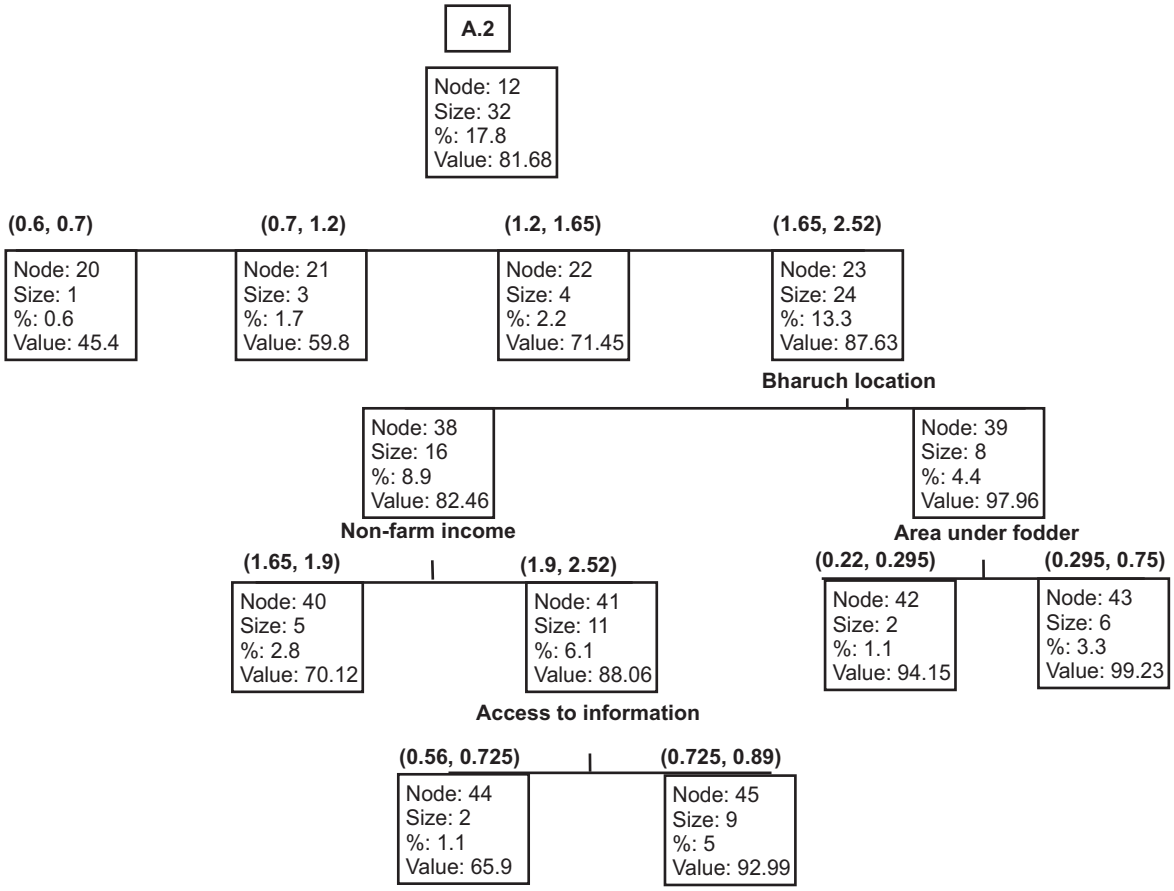


Figure 1. Regression tree

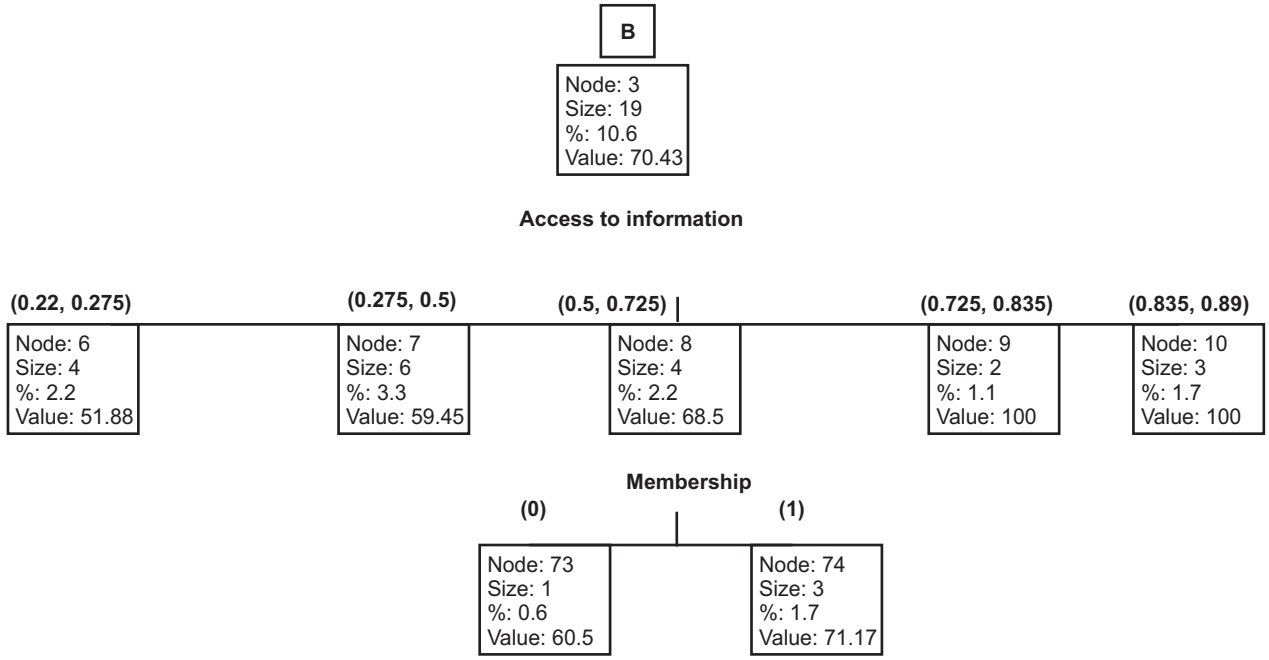
Contd....


A.1
Node: 5
Size: 82
%: 45.6
Value: 84.18
Farming experience
(7.5, 28.5)
Node: 14
Size: 60
%: 33.3
Value: 85.57
(28.5, 45)
Node: 15
Size: 10
%: 5.6
Value: 93.73
Area under fodder
(3, 7.5)
Node: 13
Size: 12
%: 6.7
Value: 69.25
Area under fodder
(0, 0.06)
Node: 48
Size: 5
%: 2.8
Value: 58.82
(0.06, 0.125)
Node: 49
Size: 3
%: 1.7
Value: 62.37
(0.125, 0.3)
Node: 50
Size: 4
%: 2.2
Value: 87.45
Area under fodder
(0, 0.06)
Node: 51
Size: 9
%: 5
Value: 69.09
(0.06, 0.175)
Node: 52
Size: 15
%: 8.3
Value: 78.65
(0.175, 0.325)
Node: 53
Size: 25
%: 13.9
Value: 91.69
(0.325, 0.7)
Node: 54
Size: 11
%: 6.1
Value: 94.6
Access to information
(0.33, 0.725)
Node: 46
Size: 2
%: 1.1
Value: 76.05
(0.725, 0.08)
Node: 47
Size: 8
%: 4.4
Value: 98.1
Access to information
(0.22, 0.61)
Node: 55
Size: 4
%: 2.2
Value: 53.93
(0.61, 0.78)
Node: 56
Size: 1
%: 0.6
Value: 78.4
Distance
(0, 0.75)
Node: 57
Size: 4
%: 2.2
Value: 81.83
(0.75, 1.25)
Node: 58
Size: 3
%: 1.7
Value: 65.43
(1.25, 1.75)
Node: 59
Size: 2
%: 1.1
Value: 49.1
Bharuch location
(0)
Node: 62
Size: 11
%: 6.1
Value: 83.37
(1)
Node: 63
Size: 4
%: 2.2
Value: 65.68
Access to information
(0.44, 0.555)
Node: 64
Size: 1
%: 0.6
Value: 68.1
(0.555, 0.725)
Node: 65
Size: 6
%: 3.3
Value: 83.18
(0.725, 0.835)
Node: 66
Size: 8
%: 4.4
Value: 94.36
(0.835, 0.89)
Node: 67
Size: 10
%: 5.6
Value: 97.01
Non-farm income
(0.48, 1.05)
Node: 60
Size: 2
%: 1.1
Value: 65.45
(1.05, 2.5)
Node: 61
Size: 2
%: 1.1
Value: 98.2
Non-farm income
(0.5, 0.65)
Node: 68
Size: 2
%: 1.1
Value: 60.55
(0.65, 1.9)
Node: 69
Size: 5
%: 2.8
Value: 83.54
(1.9, 2.5)
Node: 70
Size: 4
%: 2.2
Value: 94.58
Non-farm income
(0.84, 1.9)
Node: 71
Size: 4
%: 2.2
Value: 77.53
(1.9, 2.3)
Node: 72
Size: 2
%: 1.1
Value: 94.5

Contd....


A.2
Node: 12
Size: 32
%: 17.8
Value: 81.68
(0.6, 0.7)
(0.7, 1.2)
(1.2, 1.65)
(1.65, 2.52)
Node: 20
Size: 1
%: 0.6
Value: 45.4
Node: 21
Size: 3
%: 1.7
Value: 59.8
Node: 22
Size: 4
%: 2.2
Value: 71.45
Node: 23
Size: 24
%: 13.3
Value: 87.63
Bharuch location
Node: 38
Size: 16
%: 8.9
Value: 82.46
Node: 39
Size: 8
%: 4.4
Value: 97.96
Non-farm income
Area under fodder
(1.65, 1.9)
(1.9, 2.52)
(0.22, 0.295)
(0.295, 0.75)
Node: 40
Size: 5
%: 2.8
Value: 70.12
Node: 41
Size: 11
%: 6.1
Value: 88.06
Node: 42
Size: 2
%: 1.1
Value: 94.15
Node: 43
Size: 6
%: 3.3
Value: 99.23
Access to information
(0.56, 0.725)
(0.725, 0.89)
Node: 44
Size: 2
%: 1.1
Value: 65.9
Node: 45
Size: 9
%: 5
Value: 92.99

Contd....


B
Node: 3
Size: 19
%: 10.6
Value: 70.43
Access to information
(0.22, 0.275)
(0.275, 0.5)
(0.5, 0.725)
(0.725, 0.835)
(0.835, 0.89)
Node: 6
Size: 4
%: 2.2
Value: 51.88
Node: 7
Size: 6
%: 3.3
Value: 59.45
Node: 8
Size: 4
%: 2.2
Value: 68.5
Node: 9
Size: 2
%: 1.1
Value: 100
Node: 10
Size: 3
%: 1.7
Value: 100
Membership
(0)
(1)
Node: 73
Size: 1
%: 0.6
Value: 60.5
Node: 74
Size: 3
%: 1.7
Value: 71.17

been presented in four sections owing to its width. The root node gives the descriptive statistics of the sample. The root node has been divided into node 1 and node 2 on the basis of the distance to the dairy cooperative society from the dairy farm which indicated that the distance from village level is the foremost important factor among others. The secondary variable in order of importance for technical efficiency was found to be the membership in dairy cooperatives which is of our interest, followed by the area under fodder crops, access to information, farming experience and non-farm income. The node 2 was further bifurcated into several branches which showed that out of 180 farmers there were only 19 milk producers for whom the most influencing factor was access to information, followed by annual non-farm income. Similarly, the regression tree showed the branches based on the homogeneity among the sample farmers. The branch forming process got terminated when no explanatory variable provided any extra information.

CONCLUSIONS

Dairy cooperatives play an important role in nurturing, strengthening and providing livelihood to rural households and serve as a prominent organization for providing inputs and resource services. The value-based and principle driven cooperatives are sustainable in nature and have shown resilience to economic and financial crises. The findings of the study showed that dairy cooperative member farmers were more technically efficient than non-members and hence promotion of dairy cooperatives in cooperative poor areas could lead to more efficient and sustainable use of resources. The cooperatives should attract non-members in the study region to get enrolled in the society. The non-members are generally small farmers and they prefer to sell their milk output to the private sector or directly to the end-users because they have less quantity of marketed surplus. Non-members prefer to sell milk in the nearby outlets owing to long queue in the cooperatives. The study encourages farmers especially small dairy holders to get the support of dairy cooperatives for getting more access to information, optimal resource use and enhancing their output as well as efficiency which can pave way for sustainable dairying.

REFERENCES

Ajibefun, I.A., Battese, G.E., & Daramola, A.G. (1996). *Investigation of factors influencing the technical efficiencies of smallholder croppers in Nigeria*. CEPA Working Papers No. 10/96 Department of Econometrics, University of New England, Armidale, Australia.

Cak, B., Keskin, S., & Yilmaz, O. (2013). Regression tree analysis for determining of affecting factors to lactation milk yield in Brown Swizz cattle, *Asian Journal of Animal and Veterinary Advances*, *8*(4), 677-682.

Chandrasekar, V., Sendhil, R., & Ramasundaram, P. (2017). *Data envelopment analysis, e-compendium on data analysis tools and approaches (DATA) in agricultural sciences*. IIWBR, Karnal, 82-86.

Directorate of Animal Husbandry, Gujarat (2016). *Bulletin of animal husbandry and dairy statistics*, 2015-16. Directorate of Animal Husbandry, Government of Gujarat, Ahmednagar.

Karanja, F., Gilmour, D., & Fraser, I. (2012). Dairy productivity growth, efficiency change and technological progress in Victoria, Paper presented at the conference of the *Australian Agricultural and Resource Economics Society* .

Kulkarni, N., & Jain, J. (2015). Indian Dairy Industry Delivering growth and generating livelihoods, *Phillipcapital*, India Research: 1-3.

Larsen D.R., & Spekman P.L. (2004), Multivariate regression trees for analysis of abundance data. *Biometrics*, *60*(2), 543-549.

Mahida, D., & Sendhil, R. (2017). *Principal Component Analysis (PCA) based indexing, e-compendium on data analysis tools and approaches (DATA) in agricultural sciences*. IIWBR, Karnal, 54-56.

Mor, S., & Sharma S. (2012). Technical efficiency and supply chain practices in dairying: The case of India. *Agricultural Economics (CZECH)*, *58*(2), 85–91.

National Dairy Development Board (2016). *Annual report 2015-16.* Available at http://nddb.coop/sites/default/files/NDDB_AR_2015-16Eng.pdf

Ojo, C.O. (2012). Technical efficiency of rural women farmers in Borno State, Nigeria. *Developing Country Studies*, *2*(7), 61-67.

Ponnusamy, K. (2006). *Multidimensional analysis of the integrated farming system in the coastal agro-ecosystem in Tamil Nadu* (Doctoral Thesis). ICAR-NDRI, Karnal, Haryana.

Saravanakumar, V. (2005) *Factor demand output supply and technical efficiency of milk production in Tamil Nadu* (Doctoral Thesis). National Dairy Research Institute, Karnal.

Sirohi, S., Bardhan, D., & Premchand (2015). *Costs and returns in milk production: Developing standardized methodology and estimates for various production systems*. Project Report submitted to Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India, New Delhi.

Zheng, H., Chen, L., Han, X., Zhao, X., & Ma, Y. (2009). Classification and regression tree (CART) for analysis of soybean yield variability among fields in Northeast China: The importance of phosphorus application rates under drought conditions. *Agriculture, Ecosystems and Environment*, *132,* 98-105.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 410-415
DOI: 10.5958/2322-0430.2018.00089.6

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Role of Dairy Cooperatives in Strengthening Value Chain of Liquid Milk and its Sustainability in Karnataka: Findings from Preliminary Study

M. Vanishree[1], R. Sendhil[2], Smita Sirohi[1], A.K. Chauhan[1], H.M. Rashmi[1] and K. Ponnusamy[1]*

[1]*ICAR-National Dairy Research Institute, Karnal-132001*
[2]*ICAR-Indian Institute of Wheat and Barley Research, Karnal-132001*

[*]*Corresponding author's email: vaniveena789@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-117* *Revision Accepted: March 06, 2018*

ABSTRACT

Cooperatives play an important role in achieving and strengthening the sustainability of dairy value chain. In developing countries like India most of the small, marginal and landless farmers are engaged in dairying for their livelihood and hence there is a dire need to strengthen the milk value chain for effective and efficient performance. The present study has been carried out in Bengaluru rural district of Karnataka to analyze the existing scenario of value chain in liquid milk for suggesting policy interventions to strengthen and sustain its performance. Chain wide learning indicated the importance of dairy cooperatives in providing inputs and technical services to farmers as well as integrating production to processing. The study documented the strengths, weakness, opportunities, and threats for chain actors and finally concluded that synergy between the stakeholders right from input supply to distribution with cooperatives as chain leader will improve the performance and sustainability.

Keywords
Chain-wide learning, dairy stakeholders, dairy value chain, liquid milk, sustainability.

JEL Codes
Q01, Q12, Q13.

INTRODUCTION

Reams of literature confirm the importance of dairying and its potential in sustaining livelihood. India has profuse resources on livestock which play an important role in the socio-economic development as well sustainable livelihood of rural households. The country has one of the largest stocks in cattle and buffaloes holding around 50 per cent of the world's buffalo and 20 per cent of cattle population and also owns the pride of being the world's largest milk producer. The total milk production has reached 155.5 million tonnes and the per capita availability hovers around 337 grams per day with 6.27 percent growth per annum contributing 18.5 percent to the global milk production (DAHD, 2017).The Indian dairy sector has been contributing a substantial share in the agricultural gross domestic product (GDP). Milk and milk products constitute a major share in the total value of output from the livestock sector, which increased from less than 50 percent during 1950-51 to about 65 percent in the late 1990s (FAO, 2016).

Milk is an integral part of nutrition security and rural development contributing immensely to household food as well as livelihood security. In most of the developing countries, milk is produced by smallholders but they stand low in the efficiency scale owing to disconnect with technology and information. Dairy cooperative societies play a significant role in linking the milk producers to market and create a strong network for procurement, processing as well as distribution. Cooperatives also enhance and support the rural employment opportunities, sustainability and income generation through dairying. Dairy production systems generally located far away from consumer markets with highly perishable products, and hence they entail efficient marketing and processing along the whole value chain, right from input supply to consumption (World Bank, 2010).To realize the potential value as well as enhancing the efforts and opportunities to strengthen the dairy industry, value chain analysis gains significance.

In India, the first milk cooperative society was

registered during 1905 at Kanaginahal village located in Gadag district of Karnataka state (Challakumar & Sreenivasaiah, 2016). The state ranks 11th in overall milk produced from India and holds first position in South India in terms of milk procurement and sale (Chief Economic Adviser, 2016-2017). Karnataka Cooperative Milk Producers' Federation Limited (KMF) is the apex cooperative body at the state level and it is the third largest milk cooperatives in India (Karnataka Milk Federation, 2016). Under KMF, Bengaluru Milk Union (BAMUL) has the highest procurement as well as sale of milk with a well-connected network of milk producers. Limited research has been done on value chain applications to the dairy industry, especially in Karnataka dairying. A complete value chain analysis will facilitate to identify the issues and opportunities to strengthen the existing performance of value chain. Improving the dairy sector will benefit the producers by providing livelihoods and consumers by providing milk at affordable prices (CGIAR, 2011).In the context, the present study is an attempt to analyze the existing performance of value chain in Karnataka for suggesting policy interventions to strengthen and sustain owing to the increasing demand and changing consumers' preference for milk and milk-based products.

DATA AND METHODOLOGY

Karnataka has 13 district milk unions, of which Bengaluru Milk Union (BAMUL), a unit of KMF, has been purposively selected. BAMUL procures milk from three districts *viz.,* Bengaluru urban, Bengaluru rural and Ramnagar of which Bengaluru rural (Figure1) was selected purposively and one chilling center from the selected district was randomly chosen. From the Bengaluru rural district, three village level milk producer's cooperative societies (MPCS) has been selected based on the quantum of procurement such that one falls in each category namely less, medium and high. Under each MPCS, 20 dairy cooperative member farmers was selected randomly and two milk parlours, was selected randomly for analyzing the complete value chain in liquid milk. The data collection pertains to the year 2017. The sampling design adopted for the study has been furnished in Table 1.

Chainwide learning (CWL) methodology has been adopted for analyzing the performance of value chain actors. It is applicable to identify the issues, opportunities, and importance of different dairy stakeholders across the milk value chain (Vermeulen *et al*., 2008). CWL is a multi-stakeholder process at different levels and provides a complete snapshot of the scenario in understanding how different policies and institutions play an important role to strengthen and improve the sustainability of value chain actors, especially small-scale producers (Figure 2).

The CWL method uses the following steps in analyzing the liquid milk value chain.

1. Mapping the value chain and identification of main actors or stakeholders.
2. Mapping key policies and institutions that influence the functioning of value chain.
3. Establishing key drivers, trends, and issues affecting the value chain and its actors.
4. Exploring future scenarios in relation to uncertainty about drivers and trends.
5. Identifying options for inclusion of small-scale

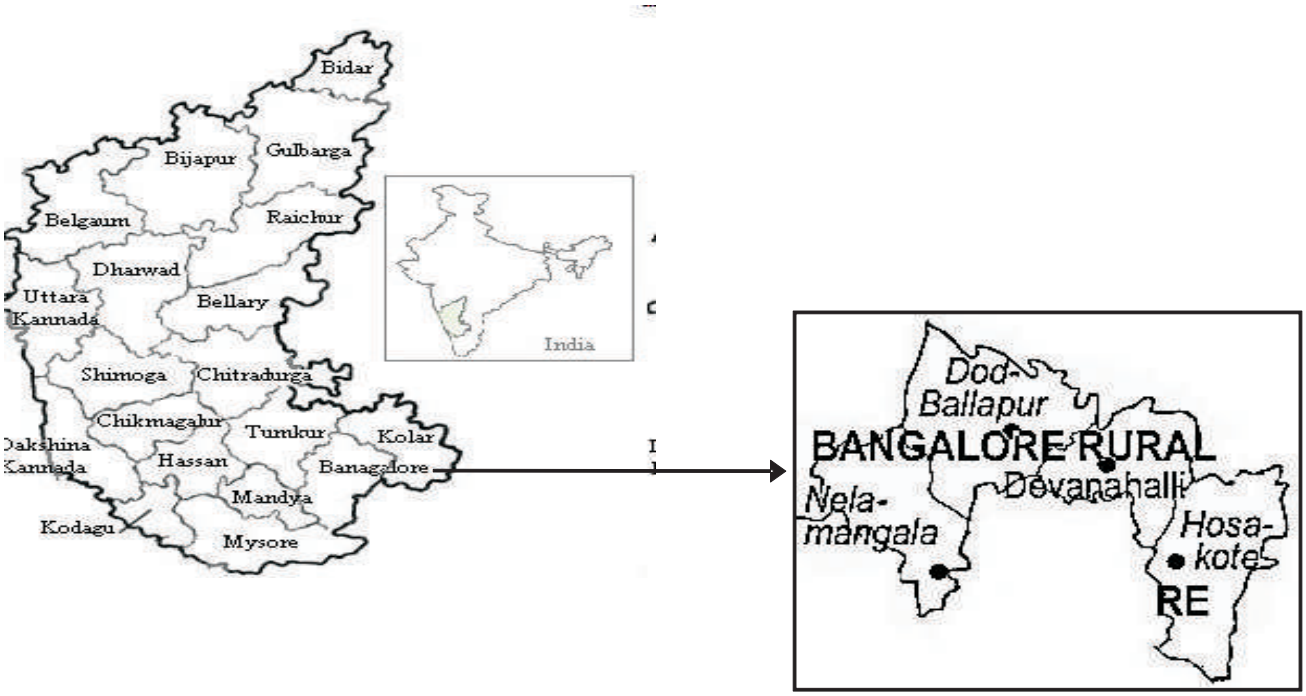


Figure. 1. Map showing the study region

producers in the value chain.

6. Developing strategies for supporting the changes in policies and institutions.

RESULTS AND DISCUSSION

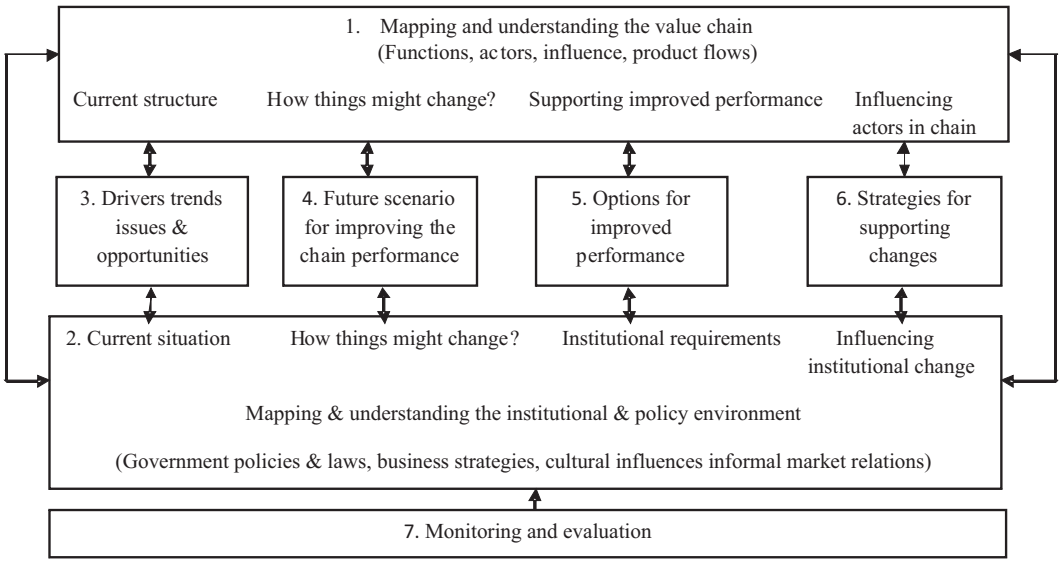
Value chain mapping: The value chain mapping gives a basic overview and structure of the chain, and facilitates to identify the core process, main actors, location and position of different stakeholders, support services and enabling environment along the chain (M-livestock Consultants, 2012). The collected data from survey in rural Bengaluru through chain wide learning has been converted into value chain map and depicted in Fig. 3 for understanding the sequence, role of different dairy stakeholders and their support services. Value chain analysis portrays the key activities within and around the core actors and relates them to their competitive strength, weakness, opportunities, and threats. For instance, dairy cooperative societies play a major role in liquid milk value chain by offering support services like procurement, transportation and technical advisories for enhancing the production. The chain analysis evaluates each activity that adds value to the organization products and/or services (Aggarwal, 2016). Mapping of the value chain (Figure 3) from the study area identified and located the key stakeholders involved in the liquid milk production to consumption.

Information on socio-economic characteristics of the sample farmers will help to devise strategies for strengthening their performance. Findings indicated that a majority of the farmers in the study region were small and marginal holders with 2-3 acres (Table 2). The average herd size of the farmers was 4.2 in terms of standard animal units (SAUs), and most of them rear crossbred cows with an average milk production of 13-14 liters per day (Table 2) but incurred high input cost. Feed and fodder accounts for more than 60 per cent of the cost spent on milk production (Desai, 2005).

Milk producer's cooperative societies (MPCS): Three MPCS were selected at the preliminary stage based on their procurement capacity of milk (Table 3). Among the selected MPCS, Madagundanahalli had the highest procurement per day (1800-1900 litres) owing to the highest member enrolment. MPCS provide dairy inputs like cattle feed, green fodder seeds, credit facility, mineral mixture and milking machine at subsidized rate to member farmer and also provide veterinary services,

Table 1. Composition of study sample

Participants	Data collection	Sample unit	Selection criteria
Dairy farmers	Survey	60	Random selection
Milk producer's cooperative societies (MPCS)	Survey	3	Random selection
Chilling centre	Survey	1	Random selection
BAMUL (milk plant)	Survey	1	Purposive selection
Milk parlour	Survey	2	Random selection



Source: Vermeulen et al., 2008

Figure. 2. Analytical framework for mapping, policies, and institutions

Table 2. Herd size, milk yield and holding size of farmers in the study area

Average herd size of farmer based on SAU*	Average milk yield (litres/day)	Average land holding (acres)
4.2	13.5	2.5

SAU Standard Animal Units*

Table 3. Procurement capacity of dairy cooperative societies

Name of the milk producers cooperative societies (MPCS)	Total membership	Quantity of milk procured/day (litres)
Madagundanahalli MPCS	450	1800-1900
Haralumallige MPCS	350	900-1000
Marenahalli MPCS	200	500

artificial insemination services, and consultancy at free of cost. It also offers yearly bonus to the members. From chain wide learning, it was found that MPCS (dairy cooperatives) play a major role across value chain in facilitating the key process of production and procurement through their support services.

Table 4 furnishes the information on processing plant and chilling centres in the study region. Doddaballapura chilling centre under Bengaluru rural district was selected which is having the capacity of 1.6 lakh litres of milk per day and procure milk from 222 MPCS.

The Bengaluru Milk Union (BAMUL) has the highest procurement rate and sale of milk among all milk unions in Karnataka. It is one of the biggest fully computerized milk unions in South India with an average procurement of 17.39 lakh litres of milk per day and sells on an average 8.92 lakh litres of milk per day. BAMUL is the chief seller of curds in the country with the lowest distribution (transportation) cost (Karnataka Milk Federation, 2016). BAMUL consists of 34210 MPCS members, 1938 MPCS, 265 distribution routes and 32 milk parlours. In the present study, it was found that the role of BAMUL was more prominent in value addition of the liquid milk. From BAMUL the value-added commodity reaches the ultimate consumers through their milk parlours. Two parlours have been selected randomly for analysing the commodity marketing in the study area. The following section presents the SWOT analysis of all the value chain actors.

SWOT analysis of value chain actors

SWOT analysis has been used to identify the strength, weakness, opportunities, and threats at each stage of the value chain. The analysis was done for input dealers, dairy farmers, and procurement agency (MPCS), processing unit (BAMUL) and wholesalers/retailers level.

Input and service supplier: Dairy inputs include feed and fodder, mineral mixture, financial assistance and services like veterinary aid, artificial insemination and other consultancy services. The SWOT analysis at input supplier level is furnished below.

***Strength*:** Farmers depend on both cooperative and private sectors for dairy inputs and services in the study region. Milk producers get inputs and services easily from the cooperative sectors at subsidized amount compared to private players. Societies provide veterinary services to the member farmers at free of cost. Most of the farmers in the study region get benefit from the dairy cooperatives.

***Weakness*:** Milk productivity depends on the quality of inputs and services. Some farmers in the study region face difficulty to access the inputs due lack of awareness and more distance to the service providers. It was reported that high transportation cost and high input cost prevented them to opt for other sources.

***Opportunities*:** Input supplier act as a backward linkage in the value chain and play an important role in the dairy sector having huge potential to develop. The quality and quantity of milk can be improved by supplying good quality of inputs at reasonable price to the farmers.

***Threats*:** High price of inputs/services and inadequate supply of inputs.

***Farmers/ milk producers*:** Farmers play an important role in dairy value chain and they are responsible for milk production. A majority of the farmers are small and marginall and holders and depend on dairying for livelihood (Table 2).

***Strength*:** Farmers produce milk with the available resources and ensure food and nutrition security.

***Weakness*:** Most of farmers are not practicing scientific

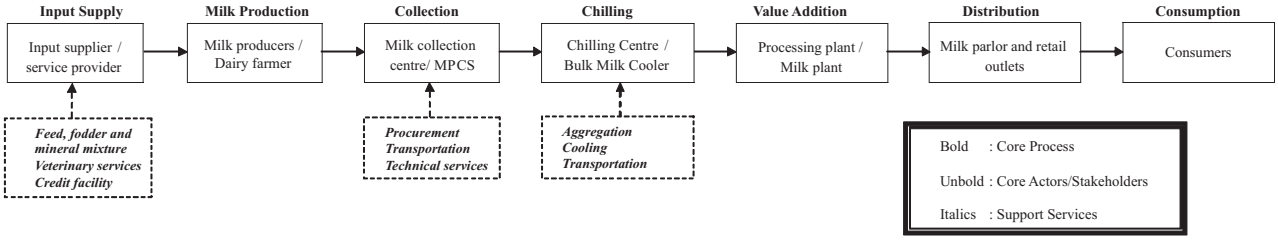


Figure. 3. Value chain mapping for liquid milk

Table 4. Bengaluru dairy (MEGA dairy) and milk chilling centres

Particulars	Installed capacity (LLPD*)	Present handling (LLPD*)	Percent utilisation of capacity
Processing plants			
Bengaluru dairy	10	12.75	128
Hosakote dairy	2	2.00	100
Chilling centres			
Anekal	1.00	0.79	79
Byrapatna	2.00	1.71	86
Doddaballapura	1.60	1.32	83
Soluru	1.60	1.79	112
Vijipura	1.00	1.27	127
Hosakote	1.50	2.00	133
Kanakapura	1.20	1.57	131
Bulk milk coolers	4.75	4.30	91
Total	16.65	14.75	--

Source: Karnataka Milk Federation.
**LLPD refers to lakhliters per day.*

management practices in milk production which will reduce the quantity and quality of milk.

***Opportunities*:** The demand for milk and milk products are increasing day by day which encourages the milk producers to produce more milk and develop strategies in processing to produce value-added products at the village level.

***Threats*:** Milk production depends on the internal and external environment and the threat has been triggered with increasing intensity of climate change.

Collection Centres/MPCS: The milk producer's cooperative societies (MPCS) are located at village level and responsible for procuring milk from the member farmers.

***Strength*:** The cooperatives have well-established infrastructure facilities like automatic milk collection, milk testing equipments for milk procurement and also provide quality inputs to members.

***Weakness*:** Cooperatives incur high procurement cost and lack of skilled labours.

***Opportunities*:** The total membership of the cooperative societies keeps on increasing and this will influence them to improve the handling capacity and infrastructure facilities.

***Threats*:** Cooperatives face the problem of adulteration of milk at producer's level and lack of adequate transportation facility may be a hindrance for desired level of procurement.

Chilling centres: Chilling centres are located at block level and responsible for procurement of milk from the dairy cooperative societies. They perform chilling activity of milk at 3^0C which helps to destroy the harmful micro-organisms and maintain the shelf life of the milk until it reaches the processing plant.

***Strength*:** Good infrastructure and equipment facility is available to handle the milk collected from the village level cooperatives societies. It adopts the scientific hygiene management practices for chilling the milk.

***Weakness*:** Chilling centre incurs high refrigeration and transportation cost of liquid milk.

***Opportunities*:** Huge scope exists for improving the handling and chilling capacity of milk by constructing better infrastructure facilities.

***Threats*:** Seasonal variation in procurement of milk forces the utilization capacity to reach low at times.

Processing plant/milk union: Processing plant (BAMUL)is located at district level. It is responsible for procurement of milk from the chilling centres and process raw milk into value-added milk and milk products.

***Strength*:** BAMUL is the highest milk procuring union in south India and procures about 15 lakh litres per day. The entire processing section is fully computerized with well-developed infrastructure facilities. The cost incurred for processing liquid milk is less in comparison to milk-based products (Narnaware, 2002).

***Weakness*:** Inadequate procurement of raw milk from dairy cooperative societies, and high cost of processing, refrigeration, and transportation.

***Opportunities*:** The processing quality of milk and milk products can be improved by improving the efficiency of the plant.

***Threats*:** Seasonal variation in handling capacity of raw milk in the study area.

Milk parlours/retail outlets: Milk parlours and consumers are the end actors in the value chain. Milk parlours are responsible for marketing and distribution of milk and milk-based products to the end users.

***Strength*:** Demand for milk and milk based products have been increasing consistently in the recent past which will increase the income generation capacity of the retail outlets. Organised and well-established milk parlours supply liquid milk to consumers at affordable price.

***Weakness*:** Seasonal variation in demand for milk and inadequate infrastructure.

***Opportunities*:** Milk parlours have opportunities to increase the holding capacity as well as selling quantity of milk.

***Threats*:** Demand and supply of milk varies seasonally. It depends on consumer's income, taste, and preference.

Overall, the study indicated the pros and cons across value chain of liquid milk. For better performance, enabling environment is needed which is generally provided by the dairy cooperatives apart from government policies and regulations. In most of the cases, investment in infrastructure will escalate the utilization capacity against the sub-optimal use by the chain actors (Staal *et al.,* 2008).

CONCLUSIONS

Dairying is a major source of employment and business opportunity for poverty alleviation. Dairy cooperatives play an important role in providing inputs and technical services to milk producers. The

cooperatives also integrate core process in the value chain like linking production to processing. The milk plant (BAMUL) does the value addition and distributes to the consumers through their outlets. The study highlighted the strengths, weakness, opportunities, and threats associated with each chain actor giving wide scope for interventions and innovations to improve their performance and sustainability. The government has to implement favourable policies with support operations under enabling environment for improving the efficiency. A synergy between the chain actors right from input supply to distribution with more emphasis on dairy cooperatives will improve the overall performance and sustainability.

REFERENCES

Aggarwal, N. (2016). Value chain practices in dairy industry. *Shrinkhla Ek Shodhparak Vaicharik Patrika, 9*(3),1-5.

Challakumar, A., & Sreenivasaiah K. (2016). Nature and scope of milk cooperatives under Bangalore milk union. *International Journal of Engineering and Management Science, 7*(4), 253-261.

CGIAR (Consultative Group on International Agricultural Research) (2011). *Dairy value chain in India: Background proposals for the CGIAR Research Program on livestock and fish.* International Livestock Research Institute (ILRI).

Chief Economic Adviser. (2017). *Economic survey, 2016-17.* New Delhi: Ministry of Finance, Government of India. Retrieved from www.indiabudget.nic.in/survey.asp.

DAHD (Department of Animal Husbandry, Dairy and Fisheries). (2017). www.dahd.nic.in/about-us/divisions/cattle-and-dairy-development.

Desai, V. (2005). *An economic analysis of milk production and disposal pattern of milk in rural area of Bidar district* (Karnataka) (Master's Thesis). ICAR-National Dairy Research Institute (NDRI), Karnal, Haryana.

FAO (Food and Agriculture Organization). (2016). Retrieved from https://fao.org.

Karnataka Milk Federation (KMF) (2016). www.kmfnandini.coop.

M-livestock consultants. (2013). *Dairy value chain mapping and analysis* (Research Report, 1- 12.) Retrieved from http://mlivestockconsultants.webs.com/Final%20%20Dairy%20Value%20Chain%20Mapping%20and%20Analysis%20Report.pdf.

Narnaware, G. (2002). *Economics of manufacturing dairy products in a plant, NDRI.* (Master's Thesis).ICAR-National Dairy Research Institute (NDRI), Karnal, Haryana.

Staal, S., Pratt, A., & Jabbar, M. (2008). *Dairy development for the resource-poor: A comparison of dairy policies and development in South Asia and East Africa* (215-235). Rome, Italy: Pro-Poor Livestock Policy Initiative.

Vermeulen, S., Woodhill, J., Proctor, F., & Delnoye, R. (2008). *Chain-wide learning for inclusive agri food market development. A guide to multi-stakeholder processes for linking small-scale producers to modern markets*. London: International Institute for Environment and Development. Retrieved from http://pubs.iied.org/16502IIED/.

World Bank. (2010). *Demand-led transformation of livestock sector in India: Achievements, challenges, and opportunities*. The World Bank, Washington, DC. Retrieved from http://documents.worldbank.org/curated/en/668321468041641776/Demand-led-transformation-of-the-livestock-sector-in-India-achievements-challenges-and-opportunities.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 416-421
DOI: 10.5958/2322-0430.2018.00090.2

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Decomposing the Effect of Technological Change in Milk Production in Khunti and Hazaribagh districts of Jharkhand

Aniketa Horo[1], and B.S. Chandel[2]*

[1]Research Scholar and [2]Principal Scientist, Dairy Economics
Statistics and Management Division,ICAR-National Dairy Research Institute, Karnal-132001

[*]Corresponding author's email: vandana.horo@gmail.com

Received: January 15, 2018 *Manuscript Number: NS-18-23* *Revision Accepted: February 15, 2018*

ABSTRACT

The present study basically focuses on decomposing the effect of crossbred technology in milk production in Jharkhand. Jharkhand government is making an effort to increase the milk production in the state by launching different dairy development programmes. It has even taken an important initiative by forming Jharkhand State Cooperative Milk Producers' Federation (JCMF) in June 2013 by signing a MoU with NDDB. The primary data for this study was collected from 130 farmer beneficiaries. Bisaliah's decomposition analysis was used to analyze the data and the results were interpreted accordingly. When technology shifted from local cow to crossbred, the total change in yield was observed to be 80. 59 percent out of which 73.31 percent was contributed by technology and 7.13 percent was contributed by achange in input use level. The contribution of neutral technological change was found substantially high which was reduced by the negative effect of non-neutral technology. It indicates that crossbred technology has high yield potential but considerable efforts are required to improve the efficient use of inputs.The technology component (73 percent) has more shares in increasing the milk yield than the contribution of improved inputs and management practices (7 percent).

Keywords
Bisaliah's decomposition analysis, Cobb-Douglas production function, crossbred cows, Jharkhand, technological change.

JEL Codes
B21, B41, C51, C82.

INTRODUCTION

In India, about 90 percent of milk production is concentrated in 14 states, out of which Uttar Pradesh, Rajasthan, Gujarat, Madhya Pradesh, Andhra Pradesh contribute 51.52 percent of the total milk production whereas the contribution of the eastern region lies at 20.18 percent. The eastern region comprises of plains of Assam, Bihar, Chhattisgarh, Eastern Uttar Pradesh, Jharkhand, Odisha and West Bengal, representing 21.85 percent of the geographical area of the country and supporting 33.64 percent of country's population. Jharkhand is one of the major eastern states formed in November 2000 by carving out 18 districts from Bihar. Presently, it contributes about 3.5 percent to the total livestock population along with 1.16 percent of milk production in the country, even the average productivity of milch cattle in the Jharkhand state (4.44 kg/day) is below the national average (5 kg/day).

As per the latest livestock census, the crossbred population was comprised of 2.93 percent of the total cattle population in the state. About 83 percent of the milk producing animals in Jharkhand was non-descript (Department of Animal Husbandry, Dairying and Fisheries, 2014). Dairy animals especially the crossbred cows suffer from nutritional deficiency and infertility because of non-availability of better quality roughages and cattle feeds, poor management, tropical heat, and excessive disease incidences.

In 2015-16, Government of Jharkhand started a scheme to distribute Holstein-Friesian cattle to BPL women farmers at 90 percent subsidy to increase milk production in the state and improve the economic condition of the farmers. In the event of lack of veterinary infrastructure and resources, it is important to investigate if this scheme launched for the introduction of crossbred

cattle has really helped the farmers and the state, and to what extent.

DATA AND METHODOLOGY

Primary data from 130 sample households were collected by conventional survey method based on well-structured schedule through personal interview of beneficiary farmers of scheme undertaken in this study.

Traditionally, technological change has been defined in terms of change in the parameters of the production function or the creation of new production functions. For any production function, the total change in output is brought about by (i) the shifts in the parameters and (ii) by the changes in the volume of inputs. The increase in the level of milk yield due to the introduction of new production technology (crossbred cow) over the old production technology (indigenous/ local cow) using the same level of inputs can be attributed to technological change.

There are two components of technological change:

Neutral technological change: Due to changes in scale parameters.

Non-neutral technological change: Due to changes in slope parameters or output elasticities of the inputs

If crossbred cattle were an improvement in dairy technology, its effect in terms of the gain in milk yield will occur in two stages. Initially, more output is gained with the existing resource base under the new production technology. This is the efficiency component and results into a shift in the production function. Second, an adjustment component of technological change is evident in the movement along the new production function. This movement along the new production function follows from the efforts of the firms to adjust to disequilibrium caused by the new level of efficiency (Bisaliah, 1975).

For decomposition analysis, Cobb-Douglas production function was used as follows:

$$Y_{ij}=A_j G_{ij}^{nj} D_{ij}^{oj} C_{ij}^{pj} L_{ij}^{qj} V_{ij}^{rj} e^{uij}$$

Where,

Yi = Value of milk produced/ day/ animal, as the dependent variable,

G_i = Value of green fodder fed/ animal/ day,

D_i = Value of dry fodder fed/ animal/ day,

C_i = Value of concentrates fed/ animal/ day,

L_i = Value of labour used/ animal/ day,

V_i = Value of veterinary treatment used/ animal/day, and

$n_j o_j p_j q_j r_j$ denote the jth technology of the partial output elasticities with respect to the values of green fodder fed, dry fodder fed, concentrates fed, labour used, and veterinary treatments used, respectively; and A_j denoted the intercept term under the jth technology.

i= no. of observations and j= 1 to 3.

The error term u_{ij} was assumed to follow the assumptions of the linear stochastic regression model. It was further assumed that the explanatory variables in this linear stochastic regression model were not perfectly linearly correlated and were free from the aggregation error.

Chow test was conducted before performing the Bisaliah's Decomposition Model in order to find out whether two functions differed structurally or not.

The null and alternate hypothesis used for testing equality of equation (1) and (2) through chow test was as follows:

H_0: $A_1=A_2, n_1=n_2, o_1=o_2, p_1=p_2, q_1=q_2, r_1=r_2$

H_1: $A_1 \neq A_2, n_1 \neq n_2, o_1 \neq o_2, p_1 \neq p_2, q_1 \neq q_2, r_1 \neq r_2$

After testing the assumption of $_1^2$ $_2^2$, the F value for testing the hypothesis was computed as follows:

$$F=\frac{(RSS_p - (RSS_1 + RSS_2))/k}{(RSS_1 + RSS_2)/(N_1 + N_2 - 2k)}$$

Follows F distribution with $(k, n_1 + n_2 - 2k)$ degrees of freedom

Where,

RSS_p = unexplained variation due to pooled function (pooled observation)

RSS_1 = unexplained variation in old technology

RSS_2 = unexplained variation in new technology

n_1 and n_2 are the sample sizes for old and new production technology, respectively.

After the rejection of the null hypothesis, decomposition analysis was carried out as per the procedure is given by Bisaliah (1975).

Shift of technology from local cow to crossbred

Thus, following three regression equations were estimated in the log-linear form:

$$\text{Ln}\, Y_1 = \text{Ln}\, A_1 + n_1 \text{Ln}\, G_1 + o_1 \text{Ln}\, D_1 + p_1 \text{Ln}\, C_1 + q_1 \text{Ln}\, L_1 + r_1 \text{Ln}\, V_1 + U_1 \quad (LC) \ldots\ldots\ldots (1)$$

$$\text{Ln}\, Y_2 = \text{Ln}\, A_2 + n_2 \text{Ln}\, G_2 + o_2 \text{Ln}\, D_2 + p_2 \text{Ln}\, C_2 + q_2 \text{Ln}\, L_2 + r_2 \text{Ln}\, V_2 + U_2 (CC) \ldots\ldots\ldots (2)$$

$$\text{Ln}\, Y_3 = \text{Ln}\, A_3 + n_3 \text{Ln}\, G_3 + o_3 \text{Ln}\, D_3 + p_3 \text{Ln}\, C_3 + q_3 \text{Ln}\, L_3 + r_3 \text{Ln}\, V_3 + U_3 (PO) \ldots\ldots\ldots (3)$$

Equations (1), (2), (3) represent milk production functions for the local cow, crossbred cow, pooled observations of crossbred cow and indigenous cow, respectively. $n_j o_j p_j q_j r_j$ denote the jth technology of the partial output elasticities with respect to values of green fodder fed, dry fodder fed, concentrates fed, labour used and veterinary treatments used, respectively.

Decomposition equation was derived by deducting the local cow milk production function from crossbred milk production function.

On deducting equation (1) from (2), the reduced form of decomposition equation was as follows:

$$[\text{Ln}Y_2 - \text{Ln}Y_1] = [\text{Ln}\, A_2 - \text{Ln}A_1] + [(n_2 - n_1)\, \text{Ln}G_1 + (o_2 - o_1)\, \text{Ln}D_1 + (p_2 - p_1)\, \text{Ln}C_1 + (q_2 - q_1)\, \text{Ln}L_1 + (r_2 - r_1)\, \text{Ln}V_1] + [n_2 (\text{Ln}\, G_2 - \text{Ln}\, G_1) + o_2 (\text{Ln}D_2 - \text{Ln}\, D_1) + p_2 (\text{Ln}\, C_2 - \text{Ln}\, C_1) + q_2 (\text{Ln}L_2 - \text{Ln}\, L_1) + r_2 (\text{Ln}\, V_2 - \text{Ln}\, V_1) + (U_2 - U_1) \quad \ldots\ldots\ldots (4)$$

This equation served as a basis to decompose the total percent change in the value of milk output into the causative factors that were previously discussed.

In the decomposition equation (4),

- $[LnY_2 - LnY_1]$: Measures approximately the percent change in the value of milk output as a result of the technological shift.
- $[LnA_2 - Ln\ A_1]$: Measures the percentage change in milk output due to neutral technological change.
- $[(n_2 - n_1)\ LnG_1 + (o_2 - o_1)\ LnD_1 + (p_2 - p_1)\ LnC_1 + (q_2 - q_1)\ LnL_1 + (r_2 - r_1)\ LnV_1]$. Measures the percent change in value of milk output due to non- neutral technological change.
- $[\ n_2(Ln\ G_2 - Ln\ G_1) + o_2(\ Ln\ D_2 - Ln\ D_1) + p_2(Ln\ C_2 - Ln\ C_1) + q_2\ (LnL_2 - Ln\ L_1) + r_2\ (Ln\ V_2 - Ln\ V_1)]$: Measures the percent change in milk output due to increased use of inputs necessitated by the new milk production technology. For instance, the term $[\ n_2(\ Ln\ G_2 - LnG_1\ )]$ within this bracket measures the contribution of the increased use of green fodder for explaining percent growth in value of milk output when dairy technology shifts from indigenous/ local cow to crossbred cow.
- $(U_2 - U_1)$: is the difference in error terms.

RESULTS AND DISCUSSIONS

The crossbred cow is an improved germplasm with the potential of higher milk yield and is considered to be a scientific intervention in the dairy sector to achieve higher milk production. There are continuous efforts at the government level to increase the adoption of crossbred cow either by directly supplying the animals to the farmers or through artificial insemination. The gain in milk yield occurs at two stages. Initially, more output is realized with the existing resource base only because of the better milk-feed conversion efficiency of the crossbred cattle. This is the efficiency component which leads to shifts in the production function. Second is the adjustment component of the technological change in a movement along the new production function. This follows from the efforts of the farm household to adjust to disequilibrium caused by the new level of efficiency.

It is a high input-high output technology which required better care in terms of feeding, breeding, veterinary and management. Because of which, resource status and management capacity of the farmer directly affects gains from the technology. In this section, gains from the crossbred technology have been decomposed as against local cow Separate production functions have been fitted to the milk production from a crossbred and local cow. In each case, milk yield per animal was regressed against independent variables namely green fodder, dry fodder, concentrate, labour and veterinary expenses considering all variable in monetary terms to take into account both quantity and quality of the variables. The coefficients of these production functions have been used to discern the gains from the technology using Bisaliah's approach.

Shift of technology from local cow to crossbred cow

This is the case when gains from crossbred technology have been estimated as against local cow (old technology). The regression estimates of milk production functions for the local cow along with crossbred cow are presented in Table 1. Order to test the null hypothesis was that there is no structural difference between both these production functions, Chow test was applied using F-statistics which was found to be statistically significant and the null hypothesis was rejected. Both the production functions were considered to be structurally different and used in decomposition analysis.

Table 1. OLS estimates of milk production function for local cow and crossbred cow

Explanatory variables	Crossbred cow	Local cow
Constant	5.6448*	4.6144*
	(0.6895)	(0.2583)
Green fodder	-0.0665*	0.0736***
	(0.2576)	(0.0179)
Dry fodder	0.1516	0.2163***
	(0.0869)	(0.0354)
Concentrate	-0.0638	-0.0882**
	(0.0397)	(0.0369)
Labour	-0.0823***	0.0724***
	(0.0198)	(0.0174)
Veterinary	0.0565*	0.0964***
	(0.0324)	(0.0273)
Adjusted R^2	0.75	0.97
Number of animals	182	36

Figures in the parentheses indicate standard errors.
******, **, and * Significant at p<0.01, p<0.05, and p<0.1.***

The perusal of Table 1reveals that all the factors included in the regression together explain 75 percent of the total variation in milk yield from crossbred cow and 97 percent of the total variation in the local cow. In case of milk production function for crossbred, the regression coefficients of concentrate, green fodder, and labour were found to be negative which may be due to an imbalance in the ration fed to these animals in the region. The technical coefficient of veterinary was positive and had a significant effect on milk production at 10 percent level of probability. The expenditure on dry fodder was having a positive effect on the value of milk production but found to be non-significant and hence, considered not to be different than zero. The value of efficiency parameter (constant) was observed to be the highest and significant at 10 percent level of probability which indicates ahigher efficiency of a crossbred cow in yielding milk. The technical coefficient of the labour input was found to be statistically significant at one percent probability of error. The coefficient which also measures an elasticity of

production in case of a power function, explains 0.0823 percent decrease in value of milk yield if the expenditure of labour increases by one percent. This may be due to excessive family labour put in dairy at the level of small and marginal farmers.

In case the of a local cow (old technology), all the explanatory variables were found to be positive except concentrate and statistically significant. The technical coefficient of the concentrate was negative but significant at five percent level of probability. The sign of the coefficient of the variable was same in case of milk production function from a crossbred cow but was having a lower value. This reveals that the concentrate was fed to the animals by the farmers not keeping in view the level of milk yield. The coefficients of green fodder, dry fodder, labour and veterinary expenses were positive and statistically significant at one percent level of probability. It indicates that milk productivity of local cow can be substantially enhanced provided more of these inputs were applied. In terms of elasticity of production, it was highest for dry fodder followed by veterinary expenses. Since most of the local cow were grazed, the feeding of dry fodder was very less leading to lesser efficiency of green fodder and that of concentrate which may be because of poor digestibility. As per the recommendations of the animal nutrition, the total dry matter intake should be apportioned in the ratio of 60:40 between roughages (green fodder and dry fodder) and the concentrate. It could be interpreted from the coefficient of dry fodder that the value of milk yield from a local cow will increase by about 0.22 percent with one percent increase in the expenditure of dry fodder. Similarly, the elasticity of production of veterinary expenses was 0.0963 percent which reveals that more veterinary care of local cow results into high milk production. The positive value of regression coefficient of labour (0.0724) in case of a local cow shows the neglect of care of these animals at the cost of the crossbred animal where the value of this coefficient was negative (-0.0823) since the data was collected from farmers having at least one crossbred animal under the scheme.

After having studied the factors affecting milk yield of local cow and the crossbred cow, the geometric mean of each of these factors was calculated to find the difference in inputs applied to both these technologies of milk production viz. local cow and crossbred cow, of structurally different production functions. Table 2 shows the geometric mean level value of inputs used and milk yield of both the dairy cattle i.e. local cow and crossbred cow.

The values of the geometrical mean of milk yield clearly reveal the higher returns from the crossbred cow as compared to a local cow. The value of milk yield from the crossbred cow was more than two times higher than the local cow. This difference may be because of genetic upgradation of crossbred cow and/or higher level of inputs applied in milk production from these animals. It was evident from the table that the values of all inputs applied in milk production from crossbred cow were also higher than the local cow. The geometric mean of labour used in crossbred cow was approximately twelve times higher than used in local cow, the effect of which was quite clear in regression analysis also. Similarly, the mean value of dry fodder given to crossbred cow was about ten times higher than what was fed to the local cow. In this event when both milk yield and level of inputs use were higher in case of a crossbred cow, the relative contribution of technology (neutral and non-neutral) and the higher level input used anincrease in milk yield can be segregated applying decomposition analysis. Thus, the regression coefficients and geometric mean levels studied above were further used for carrying out the decomposition analysis.

Decomposition of Technology Effect

The empirical results of the decomposition analysis are shown in Table 3. The calculations have been made as

Table 2. Geometric mean value of inputs used and milk yield for local cow and crossbred cow

(₹/animal/day)

Particulars	Crossbred cow	Local cow
Green fodder	10.44	3.43
Dry fodder	20.51	2.84
Concentrate	135.60	62.44
Labour	25.79	2.23
Veterinary expenses	12.91	2.34
Milk yield	307.75	137.47

Table 3. Decomposition of total gain in milk yield of crossbred over local cow

(Percent)

Sources of change	Percent attributable
Change in yield	80.59
Technological change	73.31
Neutral technological change	103.04
Non-neutral technological change	-29.73
Green fodder	-17.27
Dry fodder	-6.75
Concentrate	10.09
Labour	-12.41
Veterinary	-3.39
Change in inputs	7.13
Green fodder	-7.40
Dry fodder	29.97
Concentrate	-4.96%
Labour	-20.15%
Veterinary	9.65%
Total change	80.43%

per the decomposition equation is given in methodology. The results clearly show the proportionate contribution of the technology (neutral and non-neutral) and the input difference in total percentage gain in average milk yield. It can be observed from the table that a shift in dairy technology from local cow to crossbred led to more than 80 percent increase in milk yield keeping the milk price constant across the household. As is evident from the results, about ninety percent of the total gain in average milk yield was the contribution of technology while the share of input difference was only ten percent. Accordingly, total percentage gain in milk yield was spatto about 73 percent from technological effect and 7 percent from the difference in input use.

The total technology effect is the combination of neutral and non-neutral technological effects. The neutral technological effect is realized from the shift in the production frontier due to intercept and the sum of effect from the shift in slope elasticities is the non-neutral technological effect. In the present study, the contribution of the former component of technology was positive (103.04 percent) while it was negative (-29.73 percent) for the later component. The high positive neutral technological effect signifies that the adoption of the crossbred cow has brought an upward shift in the threshold level of milk yield, enabling the farmers to get more milk at the existing levels of input use. But due to a decrease in technical efficiency of the farmer in use of input in crossbred animals has led to the negative effect of the non-neutral technological change. This component to technology has reduced the total effect of technology by 29.73 percent.

The main factors responsible for the negative value of non-neutral technological change were in the order of green fodder (-17.27 percent), labour (-12.41 percent), dry fodder (-6.75 percent) and veterinary expenses (-3.39 percent). An increase in the use efficiency of these inputs will drastically improve the total effect of technology together by both the components. Even constant level of efficiency in the use of these inputs in the crossbred adoption would have kept the total contribution of technology at 103 percent in the increase in milk yield. This also signifies that at present level of input use, a given increase in the use of these inputs on a crossbred and local cow would increase the productivity of local cow more rapidly than the crossbred cow. Therefore, the resource use efficiency in crossbred animals may be increased by way of adopting the recommended package of practices in order to fully exploit the benefit of technology. The input used efficiently was the concentrate as it widened the gain in milk yield by 10.09 percent by reducing the negative effect of the non-neutral technological component.

The total effect of the difference in the level of input use to increase in milk yield was found to be positive. An increase of 7.13 percent in milk yield from the crossbred animal was realized because of higher use of input levels. The large gaps in the use of input between the local cow and crossbred were evident from the Table 4.5. The higher input levels which contributed positively were dry fodder (29.97 percent) and veterinary expenses (9.65 percent). The increased use of these inputs has together raised the milk productivity by about 40 percent. While the higher level of other inputs (green fodder, concentrate, and labour) together with their decrease in technical efficiency have contributed negatively to the milk yield gain.

A slight discrepancy was observed between the observed (80.59 percent) and estimated (80.43 percent) percentage gain in milk yield which may be attributed to the rounding of figures and the random error term. The random error term counts for variables not included in the model such as education of the farmer and the like. In the present study, since the discrepancy was of very low order, the results of decomposition may be considered to be satisfactory.

The results of the present study suggest that the technology component (73 percent) has more shares in increasing the milk yield than the contribution of a higher level of inputs (7 percent). The study conducted by Bhowmik (2006) also suggests that the technology component had more share in increasing the milk yield than the contribution of improved inputs. The results of a study on the decomposition of technology effect conclude that technical efficiency in utilization of green fodder, labour and concentrate has reduced under crossbred technology as shown by the negative value of their regression coefficient. The expenditure on veterinary had a positive and significant effect on the value of milk production. While in the case of a local cow, the elasticity of production of all inputs except concentrate was higher than the crossbred revealing much of the traditional knowledge with a farmer in rearing this animal.

When technology shifted from local cow to crossbred, the total change in yield was observed to be 80. 59 percent out of which 73.31 percent was contributed by technology and 7.13 percent was contributed by a change in input use level. The contribution of neutral technological change was found substantially high which was reduced by the negative effect of non-neutral technology. It indicates that crossbred technology has high yield potential but considerable efforts are required in use of inputs efficiently.

CONCLUSIONS

The results of milk production function conclude that technical efficiency in the utilization of green fodder, labour and concentrate has reduced under crossbred technology as shown by the negative value of their regression coefficient. The expenditure on veterinary had a positive and significant effect on the value of milk production. While in the case of a local cow, the elasticity of production of all inputs except concentrate was higher than the crossbred revealing much of the traditional knowledge with a farmer in rearing this animal. It can be

concluded that the feeding pattern of the animals was not properly leading to a negative effect on milk yield. Further availability of dry fodder and veterinary services would contribute positively to the milk production from all the dairy animals.

When technology shifted from local cow to crossbred, the total change in yield was observed to be 80. 59 percent out of which 73.31 percent was contributed by technology and 7.13 percent was contributed by a change in input use level. The contribution of neutral technological change was found substantially high which was reduced by the negative effect of non-neutral technology. It indicates that crossbred technology has high yield potential but considerable efforts are required to improve the efficient use of inputs. The technology component (73 percent) has more shares in increasing the milk yield than the contribution of improved inputs and management practices (7 percent).

REFERENCES

Bhowmik, P. (2006). *Economics of milk production and analysis of technological change in dairying in south Tripura* (M.Sc. Thesis). ICAR-National Dairy Research Institute (Deemed University), Karnal, Haryana, India.

Bisaliah, S. (1977). Decomposition analysis of output change under new production technology in wheat farming: Some implications to returns on research investment. *Indian Journal of Agricultural Economics, 32*(3),193-201.

Department of Animal Husbandry, Dairying and Fisheries (2014). *19th livestock census*, 2012. Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi. Retrieved from http://dahd.nic.in/sites/default/files/Livestock%20%205.pdf.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 422-426
DOI: 10.5958/2322-0430.2018.00091.4

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Comparison of Economics of Poplar-Fodder Crop-Based Agroforestry under Boundary and Block Plantation in Haridwar, North India

Himshikha[1], Charan Singh[2], and Charan Singh[3]*

[1]*Research Scholar, and* [2]*Scientist, Extension Division, Forest Research Institute, Dehradun-248006*
[3]*Principal Scientist, Agroforestry, Centre for Soil and Water Conservation Research and Training Institute, Dehradun*

[*]*Corresponding author's email: bhhimshikha654@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-137* *Revision Accepted: March 10, 2018*

ABSTRACT

Economics helps us to ensure the implication of agroforestry adoption. This study was done to analyze and compare the economics of Poplar-fodder crop-based agroforestry under boundary and block plantation patterns being adopted by the rural farmers in Haridwar district in Uttarakhand, North India. It also checks the economic profitability in terms of BCR, NPV, and IRR.Values of discounted costs and benefits were generated at 10 percent rate of interest for a period of six years on all costs applied and benefits obtained from these two models. The cost-benefit analysis was done to the values in which Benefit-Cost Ratio (BCR), Net Present Value and (NPV) Internal Rate of Return (IRR) were accounted in detail. Result has confirmed a BCR, NPV and IRR as 2.94:1, 2.84 Lakh/ha and 40.55% for Poplar-Berseem fodder (Trifolium spp.)–Chari fodder (Sorghum spp.) under boundary plantation and 2.62:1, 2.63 Lakh/ha and 22.43% for Poplar-Berseem fodder (Trifolium spp.)–Chari fodder (Sorghum spp.) under block plantation. It has been concluded from the study that cultivation of Berseem and Chari fodder crops with Poplar is more profitable under boundary plantation than that of block plantation under agroforestry systems in India.

Keywords
Agroforestry, BCR, economics, IRR, NPV, poplar, plantation.

JEL Codes
C81, Q13, Q18.

INTRODUCTION

Economics helps us to ensure the implication of agroforestry adoption. According to ICRAF (2004), "agroforestry is a practice where woody perennials are deliberately grown on the same land management unit with agricultural crops and/ or animals in the same form of the spatial mixture or in temporal sequence" (Food and Agriculture Organisation, 2005). This proposed definition clearly defines agroforestry itself as a practice. Irrespective of the definitions and specifics on its systems and practices, agroforestry as a sub-discipline of forestry and farming is generally known as the practice of growing trees and other crops in combinations under different agroforestry models. An important aspect of agroforestry adoption is to explore if agroforestry can lead greater economic returns to the farmers. While incorporating agroforestry in farming, changes in farming patterns happen. To achieve the relationship between components of agroforestry in a better operational and beneficial way, farmers need proper management options to establish that the agroforestry models which he is practicing or planning to adopt in future are actually beneficial to them. Since, the trees-crop culture of farmland and need to grow them differs from that on forests or agriculture alone and hence, an economic study of agroforestry models becomes important.

Economic studies of agroforestry models had been started with the expansion of agroforestry in India. Economics is concerned with the analysis of choice of decisions like what goods are produced with which resources, and how much of these resources may be used in order to achieve certain objectives. Economic studies of agroforestry have shown that financial benefits are a consequence of increasing the diversity and productivity of the systems which are influenced by market and price fluctuations of timber, livestock, and crops (Benjamin *et*

al., 2000). Economics of tree-crop combinations evaluates optimum input and output that a model can possibly utilize and generate within a rotation period. This in-turn solves not only the problems of economic theories in agroforestry but also facilitates practical implementation of these agroforestry models in farming systems. Cost-Benefit Analysis (CBA), as a tool in economics, has a valuable function in assessing relative inputs and outputs when capital invested and received are the key parameters of economics. All expected costs to be paid and benefits to be received are essentials in the economics of agroforestry models.

Berseem and Chari are important fodder crops for animals in the region. Fodder crops here are grown by most of the farmers rearing livestock and also for the commercial purpose. However, non-availability of the much local market has reduced profit level from the cultivation of fodder crops. The purpose of this study was to check and compare the economics Poplar and these two fodder crops based agroforestry in boundary and block plantation models when adopted by the farmers in the region.

MATERIAL AND METHODS

Study Area

In Uttarakhand state, the net sown area is 118.4 thousand ha while area sown more than once is 43.0 thousand ha. Gross cropped area is 160.09 thousand ha (NICRA, 2013). Most of the people in the rural areas of the district are farmers who keep livestock as well grow crops, sometimes with trees on their farms. Agriculture is the mainstay of livelihood in Haridwar. On a seasonal basis, Farmers cultivate a variety of field crops. These crop spp. are grown either as monoculture like sugarcane, on in rotation like paddy-wheat, groundnut-lentil etc.

Haridwar district is an agricultural and industrial area where apart from other activities farming is one of the income generating activities for farmers. Poplar (*Populus* spp.) tree species has short rotation periods i.e. 6 years when planted in farmlands. Among cereal crops; sugarcane (*Saccharum officinarum*), paddy (*Oryza sativa*), wheat (*Triticum* spp., mustard (*Brassica* spp.), lentils (*Lens culinaris*), rapeseed (*Brassica napus)*, sorghum, (*Sorghum* spp.) millet (*Pennisetum* spp.) maize (*Zea* mays) etc. are grown by farmers in combination with tree spp. Apart from these; vegetables like tomato (*Solanum lycopersicum*), ginger (*Zingiber officinale*), onion (*Allium cepa*), cabbage (*Brassica oleracea),* potato (*Solanum tuberosum*), peas (*Pisum sativum*) etc are also grown by the farmers in some areas of the district. However, the increase in population and industrial development has led to subdivision of forest and agriculture. This has also shrunken the scale of agroforestry in the area.

Data Collection Criteria

The aim of this objective was to find out the profitability of agroforestry models. Data pertaining to economics were collected on following needs as mentioned by Karemulla (2009):

1. Location- Country, region, study area
2. Physical and biological aspect: Population, land tenure, literacy
3. Market aspects: Social/market price for trees, crops, animal produces, labour, material, and operation required
4. The production: type of system, management of components

Though data pertaining to the economics of agroforestry model (regarding that year and all previous year of the tree–combination) were collected from the agroforestry farmers, data received from those farmers who were on the sixth year of rotation for Poplar and provided data for all cost and benefits occurred in these years. All costs and benefits were counted per year as bigha is the local land measurement unit. These values had been later converted on average cost/benefit to a commonly accepted unit, that is, ₹/ha. Questionnaires execution and field observation were done for required data collection.

Data Analysis

All the data for *kharif* (summer crop) and rabi (winter crop) was recorded on questionnaire basis. All the cost and income per bigha were counted for one year as bigha is the local land measurement unit considering that farmers were growing tree spp. and combination crops for a period of six years. Quantitative data for the economics of agroforestry models were entered in the spread sheet with monetary values of all costs and benefits. All costs were recorded from field data of farmers in monetary terms considering local market /social rates/charges. Discounted values of costs, for various agricultural crops, have been on the presumption that entire cost is invested at the beginning of the first year of model plantation. This has been done so, as the most of the expenditure on trees occurs at the time of sowing as previously explained by Kumar *et al. (*2004). For every studied model, data on incurred cost in Rupees was collected on basis of farmers' records of labour, materials, and operations required for planting, management, and harvesting of tree spp. and seasonal agricultural/fodder crop combinations. Similarly, total amount received in Rupees/ha as benefits/returns collected from sale value of trees, pruned wood, grains, straw, husk, dry/green fodder etc and compared with prevalent market/social rate of that product. Wage cost for agricultural labourers has been taken in man-days which varied between ₹180-200 to ₹350 per man-day during 6-8 years time period. Costs and benefits of selected agroforestry models were discounted to obtain market values.

Discount Factor=$1/(1+r)^n$……(1)

Where, r=discount rate, n=time

Cost-benefit analysis: CBA was done to understand and evaluate economics and profitability of agroforestry

models. For this, the net benefit was estimated by subtracting all costs occurred every year from all benefits (at current prices) for every year. The formula is given below:

$$\text{Net benefit} \quad {}^{t}_{t\ 0} Bt/(1 \quad i)t \quad {}^{t}_{t\ 0} Ct/(1 \quad i)t \text{.....}(2)$$

Where, ∑Bt = total occurred benefits for a period of t years,

∑Ct=total occurred cost for a period of t years

i= discount rate, *t*=time period

The Benefit-Cost Ratio (BCR) compares the discounted costs and benefits (Jain & Singh, 2000). The formula applied for calculation of BCR is given below.

$$BCR \quad {}^{t}_{t\ 0} Bt/(1 \quad i)t / \quad {}^{t}_{t\ 0} Ct/(1 \quad i)t \text{.....}(3)$$

Where, ∑Bt = Total occurred benefits for a period of t years,

∑Ct = Total occurred cost for a period of t years

i= discount rate

t=time period

The NPV was calculated and compared to the models. The highest NPV would indicate the best alternative (Godsey, 2010). The formula is given below.

$$NPV \quad {}^{t}_{t\ 0} \frac{Bt}{(1 \quad i)t} \quad {}^{t}_{t\ 0} \frac{Ct}{(1 \quad i)t} \text{.....}(4)$$

Where, ∑Bt = Total occurred benefits for a period of t years,

∑Ct=Total occurred cost for a period of t years

i = Discount rate

t =Time period

NPV determines the financial viability of agroforestry investments (Godsey *et al*., 2009). The IRR for adopted agroforestry models was also calculated by using following formula:

$$C_0 \quad {}^{t}_{t\ 1} \frac{Nt}{(1 \quad i)t} \text{.....}(5)$$

Where 'i' denotes the internal rate of return, *t* is time period and N is the constant annual benefit. Alternatively, Internal Rate of Return for each model was also checked by using IRR formula function in MS Excel programme.

RESULTS AND DISCUSSION

Model-I.Boundary Plantation Agroforestry Model (Poplar-Berseem-Chari)

In the study area, total 91 sample agroforestry farmers had been practicing this model with different age of Poplar trees. 16 farmers revealed sixth-year plantation in their field. They provided data for benefit-cost of plantation model for previous years. Total 16 ha land had covered by this model with different aged trees plantation. 4.36 ha land was under sixth-year old tree plantation. 460 ETPs/hectare were planted by the farmers. These after 91.3% survival rate remained 420 trees /hectare for sale purpose. Chari (summer), and Berseem (winter) fodder crops had been grown seasonally. ETPs purchase, labour required for layout-digging, basin preparation, planting of ETPs, and transportation expenditures were reported to be paid by the farmers. Tillage/furrowing, irrigation operations were done jointly for both; trees and combination crops. Economics in terms of occurred costs and benefits is shown in Table 1.

The perusal of Table 1 revealed that maximum expenditure was reportedon input required in labour utilization followed by tillage in land preparation done during different seasons. Farmers had revealed all cost involved in labour hired for pruning of trees, transportation of fertilizers and prune wood, sowing of seeds, irrigation, and fertilizer application. Materials like fertilizers; culture etc. had been applied to trees in the second and third year. Major collected returns in this model were from an auction of trees (₹3.36 Lakh), followed by green fodder from Chari (1.65 lakh/ha) and Berseem (₹1.35 lakh/ha). From the result, it has confirmed that overall in this model, maximum money was invested upon raising Chari fodder while maximum returns were also obtained from the sale of green fodder in both seasons which varied between ₹1550 to ₹3000 per bigha during the six-year period. Discounted costs were accounted as ₹1.46 Lakh/ha and discounted benefits were accounted as ₹4.29 lakh per ha. For this model, obtained values of economic indicators (NPV, BCR, and IRR) are shown in Table 2.

The results presented Table 2 shown that a BCR (2.94:1) NPV (2.83 Lakh) plus higher IRR (40.55%) makes this model on the top in terms of economic viability and feasibility. This has confirmed that adoption of this model in farmer field is financially viable and all cost involved under this model is feasible to farmers. In terms of total input is done, capital required for this model was reported very less because of fodder crop combinations which required moderate tillage, irrigation, labour and material demands. The result has also confirmed that compare to invested cost, this model provides sufficient gross returns. However, the viability of this model is highly dependent on the sale of fodder crops as these crops provide maximum return with minimum investment.

Model-II.Block plantation model:Poplar-Berseem-Chari

In results, among total sample farmers, 17 sample farmers were reported practicing this model with different age of Poplar trees. Data for the economics of whole plantation period was obtained from 6 farmers. The results revealed that the total 9.36 ha the land was covered under this plantation model in which, 2.16 ha of the land had been reported in sixth-year tree plantation. Economics in terms of occurred costs and benefits is shown in Table 3.

The analysis of occurred costs and obtained returns from fodder crops along with poplar has revealed that

maximum capital had been invested upon input as total labour utilization and tillage for land preparation done during different seasons. For planting of ETPS only ETPs purchase, layout-digging and basin preparation, planting labour, and transportation costs were utilized. To which ₹23660 were invested in the initial year of plantation. Expenses upon tillage/furrow/plow, irrigation were done combined for both components. All costs of the model were approximate ₹2.14 lakh/ha for six years in which maximum was invested upon the cultivation of berseem fodder. Maximum returns had been collected from the sale of trees (₹3.92 lakh/ha.) followed by sale value of green fodder (₹1.18 lakh from Berseem and ₹1. 22 lakh/ha from Chari fodder) making the gross return as ₹6.45 lakh/ha from this model. For this model, values of economic indicators (NPV, BCR, and IRR) are shown in Table 4.

The results presented in Table 4) revealed that there was a compensation at 10 percent annually accounting ₹1.62 lakh/ha as discounted cost and ₹4.32 lakh/ha as discounted benefit from this model for six years. The calculated values of NPV (₹2.64 lakh/ha.) shows good net benefit while BCR (2.62:1) and IRR (22.46%).

Discussion

The result has shown that less money was invested upon boundary plantation of poplar with both fodder crops than in block plantation. Opposite to this, more economic returns were received when these fodder crops were planted under boundary plantation which produced maximum net benefit from this model. The result has confirmed that this model 02 i.e Poplar-Berseem (*Trifolium* spp.)-Chari fodder (*Sorghum* spp.) in block plantation has provided higher profits to agroforestry farmers but not as much as obtained from model 01 i.e. Poplar-Berseem (*Trifolium* spp.)-Chari fodder (*Sorghum* spp.) in boundary plantation. However, benefits obtained as sale value of prune wood did not contribute much to overall income in both types of agroforestry model

Table 2. Detail cost-benefit analysis and values of economic indicators

	(₹lakhs/ha)
1. Costs	1.96
Occurred cost of model	1.46
2. Benefits	6.41
Occurred benefit from model	4.28
3. Values of economic indicators	4.44
Net benefit	2.94:1
BCR	2.83
NPV	40.55
IRR (Percent)	

Table 1. Economics of Poplar-Berseem-Chari fodder: boundary plantation model

	(₹/ha for six years)
A. All Costs	
1. Initial cost of 460 ETP planting (ETP cost, labour, material, and operations)	20313.00
2. Seed purchase	
Chari fodder	8352.00
Berseem fodder	10493.00
3. Tillage/plowing	
Chari fodder	
Berseem fodder	23150.00
4. Fertilizer/manures purchase	19940.00
Chari fodder	
Berseem fodder	16755.00
5. Labour cost for application of material applied and operations required	26810.00
Trees	
Chari fodder	
Berseem fodder	5940.00
Total cost of the model (₹ lakhs)	24371.00
	11380.00
	196429.00
	1.96
B. All benefits	
1. Benefits from trees	4760.00
Sale value of collected prune wood	336000.00
Auction of trees (420 Poplar trees)	
2. Benefits from green fodder	165000.00
Sale value of Berseem fodder	134820.00
Sale value of Chari fodder	640580.00
Total benefit from the model	

Table 3. Block plantation model: Economics of Poplar-Berseem-Chari fodder

(₹/ha for six years)

A. All Costs	
1. Initial cost of 525 ETP planting (ETP cost, labour, material, and operations)	23660.00
2. Seed purchase	
Chari fodder	9913.00
Berseem fodder	8561.00
3. Tillage/plowing	
Chari fodder	25475.00
Berseem fodder	21565.00
4. Fertilizer/manures purchase	
Chari fodder	15384.00
Berseem fodder	18711.00
5. Labour cost for application of material applied and operations required	
Trees	16780.00
Chari fodder	14300.00
Berseem fodder	9913.00
Total cost of the model	213919.00
B. All benefits	
1. Benefits from trees	
Sale value of collected prune wood	14000.00
Auction of trees (490 Poplar trees)	392000.00
2. Benefits from green fodder	
Sale value of Berseem fodder	117625.00
Sale value of Chari fodder	121875.00
Total benefit from the model	645500.00

Table 4. Detail cost-benefit analysis and values of economic indicators

(₹lakhs/ha)

i. Costs	2.14
Occurred cost of model	1.63
Discounted cost (rate of interest 10 per annum)	
ii. Benefits	6.45
Occurred benefit from model	4.27
Discounted benefit (rate of interest10per annum)	
iii. Values of economic indicators	4.32
Net benefit	2.62:1
BCR	2.63
NPV	22.46
IRR (Percent)	

plantation patterns. The CBA of Poplar-Berseem-Chari model in boundary plantation has confirmed it as more profitable as compared to block plantationby providing higher monetary profits when measured in terms of BCR, NPV, and IRR. The result has also indicated that fodder cultivation costs less when grown with poplar trees under boundary plantation, it is because management operations are less intensive in boundary plantation of tree species as compare to block plantation. Monetary benefit from the on-farm sale of green fodder was also recorded higher in boundary plantation. These two factors together made cultivation of Berseem and Chari fodder crop with poplar more profitable under boundary plantation than that of block plantation of this combination.

CONCLUSIONS

Among studied Poplar based boundary and block plantation models under silvopastoral practices, the economics of model 01, that is, Poplar-Berseem-Chari in boundary plantation has generated higher values in terms of Net Benefit, BCR, NPV, and IRR than model no 2 i.e. Poplar-Berseem-Chari in farm boundary plantation thus stood first when compared for overall economic performance. It is due to their low cost (less no. of trees, fewer management operations) and higher returns obtained as sale value of green fodder/ha (more from fodder crops under boundary plantation than fodder crops under block plantation). Hence, it is concluded that cultivation of Berseem and Chari fodder crops with Poplar is more profitable under boundary plantation than that of block plantation when adopted by the farmers.

REFERENCES

Benzamin, T.J., Hoover, W.l., Seifert, J.R., & Gillespie, A.R. (2000). Defining competition vectors in a temperate alley cropping system in the Midwestern USA: 4. The economic return of ecological knowledge. *Agroforestry Systems*, *48,* 79-93.

Food and Agriculture Organization. (2005). *State of the world's forests.Realizing the economic benefits of agroforestry: experiences, lessons, and challenges.* Part II Selected current issues in the forest sector. (85-95). ftp://ftp.fao.org/docrep/fao/007/y5574e/y5574e09.pdf .Accessed 15 July 2017.

Godsey, L.D. (2010). *Economic budgeting for agroforestry practices. Agroforestry in action* [On-line]. University of Missouri center for agroforestry (pp 12). http://www.centerforagroforestry.org/pubs/economichandbook.pdf accessed 02 March 2015.

Godsey, L.D., Mercer, D.E., Grala, R.K., Grado, S.C., & Alavalapati, J.R.R. (2009). Agroforestry economic and policy In Garrett H.E. Garret (Ed.) *North American Agroforestry: An integrated science and practice* (2nd ed.) (pp 315-337). American Society of Agronomy, Madison, USA.

ICRAF. (2004). *Approved definition of use and adoption.* Harare, Zimbabwe. ICRAF, Southern Africa.

Jain, S.K., & Singh, P. (2000). Economic analysis of industrial agroforestry: Poplar (Populus deltoides) in Uttar Pradesh (India). *Agroforestry Systems*, 49, 255-273.

Karemulla, K. (2009). Economic analysis of agroforestry systems methods and illustrations. In O.P. Chaturvedi, & A. Venkatesh (Eds.) *Agroforestry: Natural resource sustainability, livelihood, and climate moderation* (pp 639-659). Delhi: Satish Serial Publishing House.

Kumar, R., Gupta, P.K., & Gulati, A. (2004). Viable agroforestry models and their economics in Yamuna Nagar district of Haryana and Haridwar district of Uttaranchal. *Indian Forrester, 130* (2),131-138.

NICRA. (2013). *Managing weather aberrations through real-time contingency planning*. Annual Report 2012-13. Retrieved from http://www.nicra-icar.in/nicrarevised/images/publications/nicra_ar_2012-13.pdf.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 427-433
DOI: 10.5958/2322-0430.2018.00092.6

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Research Contribution for Rice Productivity Growth in Gujarat: As Reflected by TFP and RRI

M.G. Dhandhalya, V.D. Tarpara, and Haresh Chavda*

Department of Agricultural Economics, Junagadh Agricultural University, Junagadh-362001 (Gujarat)

**Corresponding author's email: mgdhandhalya@yahoo.co.in*

Received: December 28, 2017 *Manuscript Number: NS-18-39* *Revision Accepted: February 28, 2018*

ABSTRACT

The TFP growth of rice and its sources in Gujarat state from 1990-91 to 2011-12has been analyzed. The Tornqvist Theil Index has been used to calculate the total output, total input, and total factor productivity indices. Compound growth rates were worked out using semi-log trend equation. Two outputs and ten inputs have been used to construct output and input indices. The TFP growth of rice was stagnant (0.35percent) in 1990s, as both the input and output indices were increased at lower rates. But it moderately increased to around 1 percent per annum during the 2000s. With incorporation of technological change, rice output increased annually by 1.48 percent during 1990-91 to 2011-12. This has helped to keep the real cost of production near about stagnant from 2000s onwards, which was increased by 1.50 percent per annum in 1990s.The contribution of TFP to output growth for rice remained high about 92.16 percent during last two decades in Gujarat. This reveals that Gujarat has shown an outstanding performance of TFP growth in rice. This is credited to the release of popular varieties viz., GR-101 in 1984, GR-103 in 1990, GR-6 in 1991, Gurjari in 1997, Dandi and GR-7 in 2000, GR-8 in 2001, GR-12 in 2004, NAUR-1 in 2008, GAR-13 in 2009 and GAR-1 in 2010, in the state by the then GAU and SAUs, remarkably increased the productivity of paddy. The investment on paddy research generated annually 34.70 percent IRR found to be a high paying proposition in study period. The sources of productivity growth indicated that public investment in agricultural research, transfer of technology (extension), good monsoon and development of irrigation potential has constituted a significant source of TFP growth in rice.

Keywords
Extension, growth, indices, research, Rice, TFP.

JEL Codes
C81, D24, Q12, Q16.

INTRODUCTION

Rice (*Oryza sativa L.*) is a major staple food in India and a mainstay for the rural population and for household food security. It also plays a pivotal role for the food security of over half the world population. Uttar Pradesh, West Bengal, Odisha, Andhra Pradesh, Bihar, and Punjab are the major rice producing states in India. India has made tremendous progress in production of rice. During the year 1950-51, its production was merely 205.8 lakh tonnes, which increased to 1066.46 lakh tonnes in 2013-14. Due to sustained efforts made by policymakers, agricultural scientists, extension workers and receptive farmers, the production of rice dramatically increased manifold on account of adoption of modern production technology.

Gujarat is one of the leading states in agricultural production in the country. The Government has allocated a significant proportion of its resources to agricultural research in the state. Gujarat agricultural has recorded the fastest growth (above 9.6 percent) among all Indian states, since 2000. This is more than three times agricultural growth (2.9 percent per annum during 2000-01 to 2007-08) at all India level (Gulati *et al.*, 2009). Therefore, it is imperative to look at current research efforts and their accuracy in order to address emerging regional research needs. The most comprehensive measure of aggregate or sectoral productivity is Total Factor Productivity (TFP).

In view of the above, the present study was undertaken with the specific objectives *viz.,*(i) to measure

the temporal changes in area, production and productivity of rice crop in Gujarat; and (ii) to estimate the growth of input and output indices of rice crop, and to estimate the growth of total factor productivity and its sources, and returns to investment for rice crop research in Gujarat.

METHODOLOGY AND DATA SOURCE

In the present study, TFP is estimated taking into account two outputs and ten inputs. Output index includes main product and by-product. The ten input index comprises, seed (kg/ha), manure (tone/ha), fertilizers (kg/ha), human labour (man-days/ha), Bullock labour (pair days/ha), Irrigation (₹/ha), insecticide/ pesticide (₹/ha), miscellaneous cost (₹/ha), depreciation (₹/ha) and rental value of owned land (₹/ha). The data on input, output, and prices has been compiled from the Department of Agricultural Economics, Junagadh Agricultural University, Junagadh Campus, Junagadh collected under cost of cultivation scheme. The other required data were obtained from various published sources such as Directorate of Economics and Statistics (2016) and Department of Agricultural Economics (2016).

Analytical Framework

Total factor productivity (TFP) refers to that part of growth in output, which cannot be explained by growth in factor inputs like land, labour,and capital. Index of Total factor productivity (TFPI) measured the growth of net output per unit of total factor input. The TFP is defined as the ratio of an index of aggregate output to an index of aggregate input. Theil Tornqvist discrete approximation to the Divisia index is a most useful method for TFPI computation. The use of TFP indices gained prominence since Diewert (1976, 1978) proved that Theil Tornqvist discrete approximation to the Divisia index was consistent in aggregation and superlative to linear homogeneous translogarithmic production function. The Tornqvist index is exact for the homogenous translog production function.

The Divisia indices have two important attractive properties: (i) they satisfy the time reversal and factor reversal test for index numbers, and (ii) it is a discrete of the components, so that aggregate could be obtained by the aggregation of sub-aggregates (Kumar *et al.,*1992; 2008). An index of total factor productivity (TFP) compares changes in output with changes in aggregate inputs.

In the present study also, the Tornqvist Theil index was used for computing the total output index, total input index and total factor productivity index. These indices were calculated as follows:

Total Output Index (TOI)

Total output indices were constructed using the Tornqvist Theil index approach as follows:

$$TOI_t / TOI_{t-1} = \prod_j (Q_{jt} / Q_{jt-1})^{(R_{jt} + R_{jt-1}) ½}$$

Total Input Index (TOI)

$$TII_t / TII_{t-1} = \prod_j (X_{it} / X_{it-1})^{(S_{jt} + S_{it-1}) ½}$$

Where, Q_{jt} = Output of jth crop in t^{th} year.

Q_{jt-1} = Output of jth crop in $(t-1)^{th}$year.

R_{jt} = Output share of jth crop in total revenue in t^{th} year.

R_{jt-1} = Output share of jth crop in total revenue in $(t-1)^{th}$ year.

X_{it} = Quantity of ith input used in j^{th} crop in t^{th} year.

X_{it-1} = Quantity of ith input used in j^{th} crop in $(t-1)^{th}$ year

S_{it-1} =Share of input 'i' in total input cost in $(t-l)^{th}$ year.

In the case of TFP for a single crop, revenue share refers to the share of main product and by-product in total revenue from the crop, while output includes main product and by-product. Thus, total output and input indices for gram crop were prepared taking 1990- 91 as the base year.

Total Factor Productivity Index (TFPI)

Total factor productivity indices was computed as the ratio oftotal output index (TOI) to total input index (TII).

$$TFPI_t = (TOI_t / TII_t) \times 100$$

The estimation of input, output and TFP growth rates for any specified was done by fitting an exponential (or semi-log) trend equation to the three-yearly moving averages of input, output and TFP indices, respectively.

Sources of TFP Growth

The changes in the variables, that produce growth in TFP, have vital importance to estimate how much each of these sources contributes to the growth of TFP. As an input to public investment decisions, it is useful to understand the relative importance of these productivity-enhancing factors in determining productivity growth. Following Chand *et al*. (2011) to examine the determinants of TFP, a multiple regression technique in double log functional form was carried out. In order to assess the determinants of TFP, the TFP index was regressed against the following variables:

RES_STOK (research stock per ha of crop area);

EXT_STOK (extension stock per ha);

LIT_R (the proportion of rural population which is literate);

NPRATIO (ratio of N to P_2O_5 nutrients used);

CI (cropping intensity, percent);

IRR_GW (groundwater irrigated area to total irrigated area (GWIA/GIA);

RAIL (rail density, km per 100 sq km);

ELECT_AG (electricity consumption per ha of crop area); and

IRR_INTEN (gross irrigated area to net irrigated area (GIA/NIA);

IRR_POTEN (ratio of irrigation potential created to utilization (U/P);

KH_RAIN is average total rainfall per year in state, and

IRR_CANAL (canal irrigated area to total irrigated area (CANAL/GIA).

Regression analysis was attempted using the above variables and by clubbing together variables related to

natural resources(NARI) and infrastructure (INF). Three variables representing natural agricultural resources were clubbed together by taking their average as:

1/3 CI + 1/3 NPRATIO + 1/3 IRR_GW.

Similarly, infrastructural index (INF) was computed from infrastructural variables as:

0.6 RAIL + 0.1 ELECT_AG + 0.3 IRR_INTEN)

[The weights 0.6, 0.3 and 0.1 were based on the experts' judgement].

Model 1 below uses NARI and INF indices to estimate the effect of various factors on TFP. All major individual variables representing natural resources and infrastructure were incorporated in model 2. Accordingly, the specification of regression equations was stated as:

Model 1: TFP = f (RES_STOK, EXT_STOK, LIT_R, NARI, INF,)

Model 2: TFP = g (RES_STOK, EXT_STOK, LIT_R, CI, NPRATIO, IRR_GW, RAIL, ELECT_AG, IRR_INTEN, IRR_POTEN, KH_RAIN, IRR_CANAL)

Estimation was undertaken using a fixed effect approach for the pooled cross-section time-series state-level dataset, with corrections for serial correlation and heteroskedasticity (Kmenta, 1981). Following Evenson *et al.* (1999), the research stock variable was constructed by summing up research investment of five years by assigning weights as 0.2 in the year t-2, 0.4 in the year t-3, 0.6 in the year t-4, 0.8 in the year t-5 and 1.0 in the year t-6. The extension stock variable was constructed by summing up three years' extension investment by assigning weights as 0.2 in the year t-1, 0.4 in the year t-2, and 1.0 in the year t-3.

Returns to Research Investments

The value of marginal product for research is estimated as per below Equation:

$$EVMP\ (RES\_STOK) = b_i\ (V/\ RES\_STOK)$$

Where, V is the value of crop production associated with TEP (value of output for crop multiplied by the same share of TFP in total output), RES_STOK is the research stock and b_i is the TFP elasticity of research stock estimated from TFP models 1 and 2. The benefit stream was generated under the assumption that the investment made in research in the year t-i will start generating a benefit after a lag of five years, at an increasing rate during the next six years, will remain constant for the next six years and thereafter, it will start declining (one can also take the lag structure of 6,6,6 or 9,9,9). Following Evenson & Pray (1991), an investment of one rupee in the year t-i will generate a benefit equal to 0.1 EVMP in the year t-i+6, 0.2 EVMP in the year t-i+7,..... so on till t-i+11, and it will 0.9 EVMP in the year t-i+12. After this, the benefit will be equal to EVMP up to the year t-i+18. Then, the benefit from the year t-i+19 onwards will again star declining and will be equal to 0.9 EVMP in the year t-i+19, and 0.8 EVMP in the year t-i+20, and so on. This benefit stream can be discounted at the rate, say 'r', at which the present value of benefit is equal to one. Thus, 'r' was considered as the marginal internal rate of return to public research investment.

RESULTS AND DISCUSSION

Rice is a most important cereal in India contributes about 43percent of total cereals production. India has made tremendous progress in production of rice (Table 1). West Bengal is the highest producer of rice contributing around 14percent in the national production, followed by Uttar Pradesh and Andhra Pradesh. In last two decades, the production of rice in all major states including Gujarat has shown increasing trends**.**

It can be seen from Table 2 that though area remain constant, the production and yield of rice in India were significantly increased at the rate of 1.35 and 1.25percent per annum, respectively during last two decades (*i.e.* from 1990-91 to 2011-12). During 1990s and 2000s, the area, production, and yield were by and large increased significantly in Andhra Pradesh, Punjab, and Uttar Pradesh. Whereas in Bihar, Odisha and West Bengal the area were decreased significantly, however, by and large, the production and yield were increased. In Gujarat, during 1990s the area and production were increased significantly by 1.09 and 1.65 percent per annum, respectively but yield growth was slow about 0.56 percent per annum. Whereas, during 2000s the area, production and yield of rice has been increased at remarkable rate of 1.56, 5.44 and 3.84 percent per annum, respectively. The Gujarat registered significantly the highest growth rate in production and yield of rice during last two decades about 2.24 and 1.73 percent per annum, respectively.

Table 1. Major state wise production of rice in India

(Lakh tonnes)

States	1990-91	2000-01	2005-06	2010-11	2011-12	2012-13	2013-14	2014-15
Gujarat	9.91	6.17	13.28	16.66	17.90	14.97	16.36	22.87
Andhra Pradesh	96.54	124.58	117.04	144.14	128.95	115.10	127.25	116.75
Bihar	65.64	54.43	34.96	31.02	71.63	75.29	55.06	63.59
Odisha	52.75	46.14	68.59	68.28	58.07	72.95	76.13	82.98
Punjab	65.35	91.54	101.93	108.37	105.42	113.74	112.67	111.07
Uttar Pradesh	102.60	116.79	111.34	119.92	140.22	144.16	146.36	121.68
West Bengal	104.37	124.28	145.11	130.46	146.06	150.24	153.71	146.77
All India	742.91	849.77	917.93	959.70	1053.01	1052.41	1066.46	1054.82

Source: Directorate of Economics and Statistics, Government of India, New Delhi.

Table 2. Compound annual growth rates ofarea, production and yield of wheat in major producing states in India

(Percent)

State	Period	Area	Production	Yield
Gujarat	1990-91 to 2000-01	1.09**	1.65	0.56
		(0.0014)	(0.0052)	(0.0039)
	2001-02 to 2011-12	1.56***	5.44***	3.84***
		(0.0006)	(0.0031)	(0.0031)
	1990-91 to 2011-12	0.50***	2.24***	1.73***
		(0.0006)	(0.0018)	(0.0014)
Andhra Pradesh	1990-91 to 2000-01	0.88	2.43***	1.54***
		(0.0030)	(0.0041)	(0.0020)
	2001-02 to 2011-12	3.30***	4.40***	1.07**
		(0.0056)	(0.0066)	(0.0024)
	1990-91 to 2011-12	0.23	1.73***	1.49**
		(0.0019)	(0.0021)	(0.0008)
Bihar	1990-91 to 2000-01	-1.32	2.10	3.46
		(0.0041)	(0.0113)	(0.0106)
	2001-02 to 2011-12	-1.15**	0.22	1.99
		(0.0027)	(0.0135)	(0.0113)
	1990-91 to 2011-12	-2.80***	-1.39	1.45**
		(0.0015)	(0.0044)	(0.0037)
Odisha	1990-91 to 2000-01	0.06	-1.93	-1.99*
		(0.0006)	(0.0055)	(0.0052)
	2001-02 to 2011-12	-0.66**	1.99	2.66
		(0.0013)	(0.0095)	(0.0089)
	1990-91 to 2011-12	-0.25***	0.84	1.09*
		(0.0004)	(0.0028)	(0.0027)
Punjab	1990-91 to 2000-01	2.60***	2.86***	0.27
		(0.0016)	(0.0023)	(0.0017)
	2001-02 to 2011-12	1.22***	2.09***	0.86**
		(0.0007)	(0.0018)	(0.0017)
	1990-91 to 2011-12	1.66***	2.68***	1.06***
		(0.0006)	(0.0007)	(0.0006)
Uttar Pradesh	1990-91 to 2000-01	0.94***	2.73***	1.77***
		(0.0010)	(0.0024)	(0.0022)
	2001-02 to 2011-12	0.07	1.33	1.26***
		(0.0025)	(0.0051)	(0.0031)
	1990-91 to 2011-12	0.18	0.95***	0.77***
		(0.0007)	(0.0015)	(0.0010)
West Bengal	1990-91 to 2000-01	0.07	1.92***	1.85***
		(0.0013)	(0.0019)	(0.0016)
	2001-02 to 2011-12	-1.17***	-0.85	0.60***
		(0.0017)	(0.0016)	(0.0007)
	1990-91 to 2011-12	-0.28***	1.33***	1.63***
		(0.0006)	(0.0009)	(0.0006)
All India	1990-91 to 2000-01	0.66***	1.78***	1.11***
		(0.0005)	(0.0013)	(0.0011)
	2001-02 to 2011-12	0.17	2.01***	1.84***
		(0.0013)	(0.0033)	(0.0022)
	1990-91 to 2011-12	0.09	1.35***	1.25***
		(0.0004)	(0.0009)	(0.0006)

****** and ** Significant at one and five percent levels, respectively.***
Figures in the parentheses indicate standard error.

Growth in Input, Output and TFP Index

The first set of growth rates in Table 3 is based on three years moving average of indices of inputs, outputs, and TFP. The second set is based on annual values.

Among cereal crops, paddy is the second most important crop occupies about 8 lakh ha area in the Gujarat state. The TFP growth of paddy was stagnant (0.35 percent) in 1990s, as both the input and output indices were increased at lower rates (Table 3). But it showed around one percent annual increase during the 2000s and 1.36 percent in last two decades from 1990-91 to 2011-12. Due to slight increase in input use and incorporation of technological change, rice output increased annually by 1.60 percent during 1990-91 to 2014-15. This has helped to keep the real cost of production near about stagnant from 2000s onwards, which was increased by 1.50 percent per annum in 1990s.

The contribution of TFP to output growth for rice varied from 67.20 percent in 1990s to as high as 96.86 percent in 2000s and on an average, it remained high about 80.35 percent during last two and half decades in Gujarat. This reveals that Gujarat has shown an outstanding performance of TFP growth in paddy in the state. Chand *et al.* (2011) in their TFP analysis of rice in India, revealed that during 1975-2005 more than 50 percent of the rice output in Tamil Nadu, Andhra Pradesh, and Bihar was attributed to TFP and technological change. The Northern region has shown the highest growth in TFP (1.43 percent) and minimum in the Western region (0.17 percent). Gujarat has shown moderate performance of TFP growth in rice from 2000s onwards, is a good indicator of improvement in production technology in the state.

The achievement of moderate growth of TFP for paddy in Gujarat from 2000s onwards is credited to the release of popular varieties *viz.,* GR-101 in 1984, GR-103 in 1990, GR-6 in 1991, Gurjari in 1997, Dandi and GR-7 in 2000, GR-8 in 2001, GR-12 in 2004, NAUR-1 2008, GAR-13 in 2009 and GAR-1 in 2010, in the state by the then GAU and SAUs, remarkably increased the productivity of paddy.

This is clear evidence explained by TFP analysis, that the research expenditure incurred in last three decades for evolving better varieties of rice crop in the state had played a greater role for increasing productivity, as well as keeping lower cost of production, in the state.

Sources of Total Factor Productivity

A rise in production can be attributed to a growth in inputs or growth in total factor productivity. Productivity growth encompasses changes in efficiency as well as changes in the best practice. As far as sources of productivity change are concerned, the technical change component assumes greater significance. The changes in the variables, that produce growth in TFP, have vital importance to estimate how much each of these sources contributes to the growth of TFP. An attempt has been made to further analysis in terms of contribution of various factors to TFP growth.

The estimates of regression coefficients which measure the effect of various sources of TFP were used to compute elasticity of TFP with respect to research stock and to assess the impact of research has been presented in Table 4. It indicates that government expenditure on agricultural research and education, extension education, development of irrigation potential, infrastructure, canal irrigation and good monsoon in the state has positive and significant impact on TFP. Besides, balance use of nitrogen and phosphoric fertilizers and groundwater irrigation have also positive effect on TFP of rice. Whereas, rural literacy and electricity consumption has been found to be negative, as the migration of rural literates tourban areas due to availability of increased non-farm employment opportunities and distress like conditions in agriculture sector and largely the rice area is under canal irrigation might be the reason for negative effect of rural literacy and electricity consumption from Table 4 it can be further revealed that TFP elasticity with respect to research stock ranged from 0.2698 (Model 1) to

Table 3. Annual growth rate in input use, output, TFP and real cost of production (RCP) for paddy crop in Gujarat: 1990-91 to 2011-12

(Percent)

Period	Input growth	Output growth	TFP growth	RCP growth	Share of TFP in output growth
Based on three- year moving averages					
1990-91 to 2000-01	0.17	0.52	0.35	1.50	67.20
2001-02 to 2011-12	0.03	1.05	1.01	0.61	96.86
1990-91 to 2011-12	0.11	1.48	1.36	-0.56	92.16
1990-91 to 2014-15	0.31	1.60	1.29	-0.29	80.35
Based on "normal" years values					
1990-91 to 2000-01	0.07	1.02	0.94	0.95	92.73
2001-02 to 2011-12	-0.14	0.50	0.64	1.01	(-)
1990-91 to 2011-12	0.15	1.45	1.30	-0.53	89.67
1990-91 to 2014-15	0.44	1.68	1.23	-0.06	73.37

Normal years excludes year of extreme drought and poor weather (2000-01).

Table 4. Determinants of TFP for rice crop in Gujarat (1990-91 to 2011-12)

Variable	Regression coefficient	Standard error	't' statistics	Level of significance
Model 1				
Constant	2.8586	2.1230	1.3465	--
RES_STOK	0.2698***	0.0785	3.4376	0.0037
EXT_STOK	0.0276	0.0197	1.4036	0.1808
LIT_R	-0.0170**	0.0098	-1.7345	0.1033
NARI	0.1958	0.4876	0.4015	0.6937
INF	-0.0854	0.0568	-1.5037	0.1534
RAIN	0.1679***	0.0662	2.5377	0.0227
Adjusted R-Squared	0.9224			
Model 2				
Constant	-3.8542	2.8899	-1.3337	--
RES_STOK	0.2751***	0.0874	3.1491	0.0118
EXT_STOK	0.0506**	0.0208	2.4312	0.0379
LIT_R	-0.0191	0.0119	-1.5967	0.1448
NPRATIO	0.0880	0.0725	1.2139	0.2557
CI	-0.0004	0.0048	-0.0847	0.9343
IRR_GW	0.0878	0.1497	0.5864	0.5720
RAIL	0.9520*	0.5388	1.7669	0.1110
ELECT_AG	-0.2114***	0.0531	-3.9798	0.0032
IRR_INTEN	-0.0002	0.0032	-0.0589	0.9543
IRR_POTEN	0.7226**	0.3692	1.9574	0.0820
RAIN	0.0265	0.0762	0.3480	0.7358
GCA_CANAL	0.0781	0.0708	1.1033	0.2985
Adjusted R^2	0.9582			

****** and ** Significant at 1 and 5 percent levels, respectively.***
All variables specified in logarithms, except those variables defined in percentage terms.

0.2751 (Model 2) for rice. The inverse of this elasticity gives research stock flexibility which represents the required increase in research stock to increase in TFP by one percent. This estimates show that to achieve one percent increase in TFP, the minimum investment in research need to be increased by 3.70 percent annually.

Returns to Investment on Gram Research

The estimated value of marginal product (EVMP) of research investment has been presented in Table 5 revealed that additional investment of one rupee inrice crop research generated an additional output worth ₹. 8.18 during 1990-91 to 2011-12 in Gujarat.

The internal rate of return (IRR) to research investment for rice crop of which research stock coefficient in TFP decomposition equation was statistically significant has been estimated following the assumption given in the methodology section. The result indicated that during the period 1990-91 to 2011-12, the overall rate of return to public agricultural research investment turned out to be 34.70 percent for rice crop in Gujarat.

Table 5. Estimated value of MVP and IRR to research investment for rice crop in Gujarat

Period	Value of marginal product (₹)	Internal rate of return (Percent)
1990-91 to 2011-12	8.18	34.70

SUMMARY AND CONCLUSIONS

Gujarat state has one of the best public agriculture research establishments in the country. The state has good infrastructure for research and professional staff. However, the current period of economic transition and policy reform is accompanied by budget constraints that motivate careful rationing of public investment funds, making it increasingly important to assess the economic rates of return to agricultural research and other public investments. The present study has estimated the total factor productivity growth of rice crop in Gujarat during 1990-91 to 2011-12 and analyzed the factors affecting it at the state level. The study has used farm-level data collected under the Cost of Cultivation Scheme. A widely used Tornqvist-Theil Index was used for constructing aggregate output and aggregate input of the crop. Two outputs and ten inputs have been used to construct output and input index.

The analysis of TFP of rice crop in the Gujarat showed as tagnant productivity growth during the nineties. Vitally increased significantly, during 2001-02 to 2011-12 and registered moderately (>1.0-2.0percent) growth in TFP throughout last two decades. The contribution of TFP to output growth for rice remained

high about 92.16 percent during last two decades in Gujarat. This largely contributed to the release of popular varieties *viz.,* GR-101 in 1984, GR-103 in 1990, GR-6 in 1991, Gurjari in 1997, Dandi and GR-7 in 2000, GR-8 in 2001, GR-12 in 2004, NAUR-1 in 2008, GAR-13 in 2009 and GAR-1 in 2010, in the state by the then GAU and SAUs, remarkably increased the productivity of paddy.

Further, the analysis of determinants of rice TFP indicates that the government expenditure on crop research, extension education, development of canal as well as groundwater irrigation, *Kharif* rain, balanced use of nutrients and road infrastructure in the state are the important drivers of rice crop productivity in Gujarat. Returns to investment on rice crop research have been found to be a high paying proposition giving 34.70 percent IRR annually. It is essential that more public and private investments on technology improvement and development of irrigation infrastructure in the state through a favourable policy environment to sustain and further increase in TFP growth.

REFERENCES

Chand, R., Kumar, P., & Kumar, S. (2011). *Total factor productivity and contribution of research investment to agricultural growth in India.* Policy Paper 25. National Centre for Agricultural Economics and Policy Research, New Delhi.

Department of Agricultural Economics. (2016). *Research Report Department of Agricultural Economics.* Junagadh Agricultural University, Junagadh.

Directorate of Economics and Statistics. (2016). *Annual report*. Directorate Economics and Statistics, Government of India, New Delhi.

Diewert, W.E. (1976). Exact and superlative index numbers. *Journal of Econometrics, 4*, 115-145.

Diewert, W.E. (1978). Superlative index numbers and consistency in aggregation. *Econometrica, 46*, 883-900.

Evenson, R.E., & Pray, C.E. (1991). *Research and productivity in Asian agriculture.* Ithaca and London: Cornell University Press.

Evenson. R.E., Pray, C.E., & Rosegrant, M. W. (1999). *Agricultural research and productivity growth in India.* Research report 109. International Food Policy Research Institute (IFPRI), Washington, D. C., USA.

Gulati, A., Shah, T., & Shreedhar, G. (2009). *Agriculture performance in Gujarat since 2000. Research Report.* International Food Policy Research Institute (IFPRI), Washington, D. C., USA.

Kmenta, J. (1981). *Elements of Econometrics, second edition.* New York: Macmillan.

Kumar, P., Mittal, S., & Hossain, M. (2008). Agricultural growth accounting and total factor productivity in South Asia: A review and policy implications. *Agricultural Economics Research Review, 21*(2), 145-172.

Kumar, P., & Mruthyunjaya. (1992). Measurement and analysis of total factor productivity growth in wheat. *Indian Journal Agricultural Economics, 47*(3), 451-458.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 434-436
DOI: 10.5958/2322-0430.2018.00118.X

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Popularization of Direct Seeded Rice for Sustainability in Sangrur District of Punjab

Prabhjot Kaur[1], Jasvir Singh Gill[2], Pankaj Kumar[3] and Parmveer Singh[4]*

[1]Professor of Extension Education, [3]Assistant Extension Specialist and [4]Senior Research Fellow
Department of Extension Education and [2]Assistant Agronomist, Department of Farm Machinery and Power Engineering
Punjab Agricultural University, Ludhiana-141004

[*]Corresponding author's email: parm.coaext.pauedu@gmail.com

Received: December 31, 2017 *Manuscript Number: NS-18-73* *Revision Accepted: February 16, 2018*

ABSTRACT

The demonstrations for the popularization of Direct Seeded Rice (DSR) were conducted in Kharif season, 2017 in selected villages Chatha Nanhera and Taranji Khera of Sangrur district. A total of 50 frontline demonstrations were conducted covering 0.4 ha area for each demonstration. Short duration variety of paddy PR 126 was grown. Farmers were using excessive doses of fertilizers and pesticides in transplanted rice (local check). Demonstrated plots yielded 79.46 q/ha while the average yield of local check was found to be 80.49 q/ha. The highest grain yield was found to be 81 q/ha and lowest has been reported as 75 q/ha.The total cost of cultivation of the DSR was found to be₹25370/ha, while it was ₹32474/ha in the case of traditional method. A gross return of ₹115217/ha and ₹116717/ha was earned in DSR and transplanted rice respectively. Similarly, net returns of ₹89837/ha and ₹84239/ha was observed in the DSR and traditional method of cultivation. The cost-benefit ratio of the demonstrated field has been found 1:3.54 whereas it was 1:2.59 in the case of transplanted rice.

Keywords
Direct seeded rice, front-line demonstrations, sustainability.

JEL Codes
C81, O01, Q12, Q16, Q18.

INTRODUCTION

In Punjab, paddy is a major *kharif* crop cultivated on an area of 29.70 lakh hectares with total production of 111.11 lakh tonnes (Indiastat, 2016). Cultivation of paddy has posed serious concerns about sustainability and ecological imbalance in the state because it is not a traditional crop Punjab. It is a water-loving crop which is resulting in depletion of underground water. It is projected that by 2023 in central Punjab, water table depth will go below 70 feet in 60 percent area below 100 feet in 34 percent area and 130 feet in 7 percent area. Correspondingly, each district the percent below 70 feet depth will be 100 percent in Moga and Sangrur. There is dire need to develop water-saving technologies and promote conservation agriculture through various resource-conserving technologies. The Punjab Agricultural University Ludhiana recommended resource conservation tillage technologies in zero tillage, happy seeder, laser leveler and direct seeded rice for effective and efficient use of natural resources (Balasubramanian & Krishnarajan, 2000). Direct Seeded Rice (DSR) is the technology of saving water, labour,and energy along with eco-friendly characteristics and can be a potential alternative to conventional puddled transplanted rice (Kumar & Ladha, 2011).

Sangrur is one of those districts where area under long duration rice varieties is large which are not recommended for cultivation by the Punjab Agricultural University. About 68 percent of rice area was sown with such un-recommended varieties. Due to cultivation of long duration varieties, groundwater table is declining at an alarming rate. Water table in Sangrur district fell at the rate of 96 cm/year during 1998 to 2015. The basic challenges of the farming in Sangrur are lower water

productivity in puddled transplanted rice, higher cost accrued on nursery raising and subsequent transplanting, deterioration of soil structure due to puddling, technology gap between recommended techniques of application of pre-emergence herbicides and farmers practice, higher CH_4 emission from submerged fields, etc. So popularization of DSR has become imperative in this district to mitigate these problems.

MATERIAL AND METHODS

The demonstrations for the popularization of DSR were conducted in *Kharif* season, 2017 in selected villages Chatha Nanhera and Taranji Khera of Sangrur district. A total of 50 front line demonstrations were conducted covering 0.4 hectares area for each demonstration. Before conducting the FLDs a benchmark survey and soil sampling was done of the village was done and consequently, potential farmers were identified as suggested by Choudhary (1999). The sowing of direct seeded rice was done by a novel machine named Lucky Seed Drill fitted with Automatic Spraying Attachment developed by Punjab Agricultural University especially for the application of pre-emergence herbicides in different crops. Trainings to the selected farmers on cultivation of DSR were provided by the scientist of PAU, Ludhiana. Besides, regular visits and distribution of the relevant literature were given to ensure the regular information to farmers. Group meetings were also organized to share the experience of the farmers for lateral spread of DSR technology. One field day was also organized to show its benefits to different extension functionaries and farmers. Data were collected for both FLDs and control plots. Suitable statistical tools were applied for the analysis of data.

RESULTS AND DISCUSSION

To popularize the DSR in the area, 50 front line demonstrations were conducted at farmers' field. Each demonstration was covering area of 0.4 ha. In parallel local check was also laid down. In local check the farmers' practice, transplanting of paddy was done on equal area for each farmer. Results on different parameters about these demonstrations are as follows:

Comparison between Demonstrated Technology Package and Farmers' Practices

Observations of the FLDs of Paddy were compared with farmer's practices. The observations have been tabulated in Table 1. The results revealed that in both demonstrations and local check plots, short duration variety of paddy PR 126 was grown. Sowing for the Direct Seeded Rice was done in the second fortnight of June. Whereas farmers sow the seeds for seedlings in the second fortnight of May and seedlings are transplanted in second fortnight of June. Apparently, DSR technology saved water, labour and other expenses for one month. The seed treatment was completely missing in the farmers' practices. Farmers were sowing the paddy while using 13.46 kg/ha of seed in transplanting method which was less than the recommended seed (20 kg/ha). Farmers were applying excessive doses of fertilizers. It was also observed that farmers were applying broad range of chemicals at non-recommended time and doses even when no pest attack was observed.

Yield Performance of the of Direct Seeded Rice versus Transplanted

The perusal of Table 2 revealed that on an average demonstrated plots yielded 79.46 q per ha. Comparatively the average yield of local check was found to be 80.49 q per ha. The highest grain yield was found to be 81 q per ha and lowest has been reported as 75 q per ha. Although yield in transplanted rice was on higher side but the yield gap was not much wide to rule out various benefits of DSR which would be discussed in following section.

Economic Analysis of the Front Line Demonstrations on DSR

Economics is as an important aspect associated with any technology. Success of the technology is predominantly depends upon the monetary returns as a result of adoption of that particular technology and DSR is not an exception. Firstly, the farmers compare returns from existing practice with other better options. Secondly, within particulars crops, they compare whether the demonstrated technology package gives an additional

Table 1. Comparison between demonstrated technology package and farmers' practices

Particulars	Demonstrated field	Farmers' field
Variety	PR 126	PR 126
Seed rate (kg/ha)	20	13.46
Sowing time	June 15-20	May 10-30 (sowing); June 15-30 (transplanting)
Seed treatment	100percent	Absent
Line spacing	20 cm	Not maintained
Fertilizers (q/ha)	Urea: 275	Excessive dose of all (N,P,K) fertilizers
Weed management	Nominee Gold, Stomp	Variety of applicant
Pest management	Need-based sprays at recommended dose	Broad application of the chemicals at varied doses

Table 2. Yield performance of the direct seeded rice and transplanted rice

Variety	No of farmers	Area (ha)	Yield (q/ha)			
			Demonstrations			Local
			High	Low	Average	
PR 126	50	0.4	81	75	79.46	80.49

Table 3. Economic impact analysis of the demonstration of DSR and local check

(Per ha)

Particulars	Technology	Amount (₹)
Average cost of cultivation	FLDs	25380.00
	Local technology	32474.00
Average gross return	FLDs	115217.00
	Local technology	116717.00
Average net return (Profit)	FLDs	89837.00
	Local technology	84239.00
Benefit-Cost ratio	FLDs	3.54
	Local technology	2.59

advantage in terms of money or not with respect to locally prevalent technology (Kumar *et al*., 2015).The results presented in Table 3 revealed that the total cost of cultivation of the DSR was found to be ₹25370/ha, while it was ₹32474/ha in case of traditional method of growing. It showed that cost of DSR cultivation was much less than that of transplanted rice and saved about 22.0 percent of cost. If we had a glance at the gross returns it is clear that ₹115217/ha and ₹116717/ha was earned in DSR and transplanted rice respectively. Subsequently the net returns of₹89837/ha and V84239/ha was observed in the DSR and traditional method of cultivation. Here we can see that despite a bit lesser yield a more net profit was gained in case of DSR. The cost-benefit ratio of the demonstrated field has been found 1:3.54 whereas it was 1:2.59 in the case of transplanted rice. This might be credited to the less labour and water requirement in DSR as compared to farmers' field.

Feedback about DSR Technology

1. Farmers were completely ignorant about the appropriate time and adequate dose of the agrochemicals.
2. Selection and prime source of availing information agrochemicals was the chemical retailers.
3. There was belief of the farmers that high application of the fertilizers lead to higher doses and better yields.
4. There was no inclination of the farmers towards reading and following the agriculture literature. More reliance of the farmers was on their self-experience.
5. Seed treatment was completely absent among the farmers practices.
6. Earnest efforts were made to realize the farmers about following the recommended practices right from selection of seed, seed rate, use of fertilizers and agrochemicals. Farmers felt motivated after observing the results of FLD on Direct Seeded Rice.

CONCLUSIONS

Sustainability of agriculture is a serious concern now-a-days. Present day agricultural practices are detrimental to our natural resources. Keeping in view the high and assured returns, it was very difficult to replace paddy cultivation in Punjab (India). So to conserve our precious natural resources especially the water it is need of the hour that we have to adopt different techniques which results in water saving. DSR is one of the technology which helps in saving labour and water to some extents without affecting the yields or net returns rather gave more net returns than the transplanted rice.

REFERENCES

Balasubramanian, R., & Krishnarajan, J. (2000). Weed population and biomass in direct-seeded rice (*Oryza sativa*) as influenced by irrigation. *Indian Journal of Agriculture, 46,*101-106.

Choudhary, B.N. (1999). *Krishi Vigyan Kendra-A guide for KVK managers* (pp. 73-78). New Delhi: Division of Agricultural Extension, ICAR.

Indiastat. (2016). Area and production of rice in India and Punjab. Retrieved from http*//www.indiastat.com* on 10/8/16.

Kumar, P., Singh, K., & Kaur, P. (2015). Economic impact of frontline demonstration on pulses in Punjab–A step towards diversification. *Indian Journal of Economics and Development 11*(1): 111-116.

Kumar, V., & Ladha, J.K. (2011). Direct-seeded rice: Recent development and future research needs. *Advances in Agronomy, 111*, 297-413.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 437-443
DOI: 10.5958/2322-0430.2018.00093.8

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Purchasing Behaviour of Farmers' Towards Non-Durable Inputs: A Case Study

Parmeshwar Kushwaha and Rakesh Singh*

Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, U.P.

**Corresponding author's email: p94kushwaha@gmail.com*

Received: September 10, 2017 *Manuscript Number: NS-18-06* *Revision Accepted: March 10, 2018*

ABSTRACT

Agricultural production is directly affected by use of various inputs applied by farmers. During green revolution, the major factor which attributed production enhancement was inputs. Farmers' purchase decisions rely on the individual's own personality traits, purchasing capacity and technical knowledge. The personality traits do not remain constant for whole life span but it may change with the life cycle. Income level and the choice of occupation play a vital role in purchasing decision that means it is indirectly related to the demographic factors of the specific environment. The study examined the pre-purchase, purchase and post-purchase behavior of non-durable inputs. The primary and secondary data for agricultural year 2013-15 had been taken for the study. ***Eastern region of Uttar Pradesh was selected*** *purposively on the basis of highest number of households in the area. Ten percent of total 27 districts having maximum population of farming households (Jaunpur, Paratpgarh, and Gorakhpur) of Eastern Uttar Pradesh were selected purposively. Descriptive statistics a tool was used to purchasing behavior of farmers for non-durable inputs. The results revealed that most of the decision for pre-purchase of inputs was taken by male/father of family. Purchase decision is mainly affected by purchasing power/availability of capital with the farmers. It was found that farmer is risk averse and do not want to take credit/loan for purchase of inputs. They prefer cash as a mode of payment. For the post-purchase decision the reasons for shifting the brands of non-durables inputs, it was found that high price, non-availability and low quality of Inputs are the main factor affect the post-purchase decision. Improving purchasing power of farmers, ensuring quality inputs at right time may increase the application of non-durable inputs and ultimately agricultural production.*

Keywords
Behaviour, durable, input, non-durable, purchase.

JEL Codes
C19, C81, D19, D71, Q13.

INTRODUCTION

Indian agriculture is presently facing the challenge of feeding a billion plus population of the country with little scope for increasing the acreage. Thus, to promote agricultural growth the only option left is to increase the productivity through judicious use of inputs and improved technology (Swaminathan, 1991; Goyal, 2010; Babu *et al*., 2013; Girabi & Mwakaje, 2013). In this context, inputs purchase decision refers to the behavior selection of farmers, driven by interest, with maximum benefit based on their own resources, experience, and environmental limitation according to the natural condition and social economy condition. The purchase behavior of farmer's agricultural inputs, purchase mostly focus on the agricultural output value, agricultural and subsidy policy implications.

Marketers should know the answers to feelings of the farmer after buying and using the product, his reactions, when satisfied, when dissatisfied and how does he dispose of the product after use. Farmers make purchase decisions in each and every aspect of their life. Thus studying farmers' behavior becomes more vital. All marketing decisions & activities are based on assumptions about farmers' behaviour (Agrawal, 2016).

In India, farms are in general small-scale businesses without compartmentalization and formalized procurement procedures. Management, including purchasing, is primarily the responsibility of the farmer,

and the labor is provided by the farmer, his family and sometimes employees. Although the farmer often carries out the purchase, the buying decision can be made autonomously by the farmer or jointly with other family members. This buying situation is very similar to the buying decision-making within households. In this context, one member of the household does the shopping, but the whole family may decide about which products are bought. Another important aspect of the buying behavior of family farms is the interdependency between expenditures on household consumption and on means of production (Kool, 1994). Given a particular income level, an increase of the expenditures on farm production goes at the expense of expenditures on consumption and vice versa

It is important to understand non-durable inputs use behavior in the country over time as well as role of factors influencing of non-durable inputs at study area. It is necessary for the marketers to understand as to how the farmer makes his buying decisions, which makes the buying decisions, the type of decisions involved and the steps in the buying process. A rural farmer spends lot of time before making purchases. He cannot be easily coaxed to buy a new good. Farmers buy durables during postharvest season and festivals. Agricultural input suppliers currently face unique marketing challenges. For many agribusiness input suppliers, large commercial farm enterprises have replaced traditional smaller farms as their primary customers. Understanding relationship dynamics in this emerging market environment is becoming more important. However, over a period there is a change in the purchasing behaviour of farmers regarding durable and non-durable agricultural inputs so it's important to study the preferences of farmers with respect to brand, quality, price, and availability of resources, etc.

METHODOLOGY

Study was conducted in eastern region of Uttar Pradesh as it has highest number of households. Both primary and secondary data for agricultural years 2013 to 2015 were collected. Out of 28 districts of Eastern Uttar Pradesh, Ten percent districts having maximum population of farming households were selected (Jaunpur, Pratapgarh, and Gorakhpur). From each district two blocks, one having highest cropping intensity and other having lowest cropping intensity were selected thus total 6 blocks, Dharmapur, Rampur Sangramghan and Bhathat (from Jaunpur, Pratapgarh, and Gorakhpur district respectively) having high cropping intensity and Karanjakala, Sandwa Chandrika and Jangal Kaudia (from Jaunpur, Paratpgarh, and Gorakhpur district respectively) having low cropping intensity were selected. From each block, one village was selected randomly (6 villages Pachewra, Hernahar, Rampur Buzurg, Saraiya, Gobari and Baranpur Talalikhiya from Dharmapur, Rampur Sangramghan, Bhathat, Karanjakala, Sandwa Chandrika and Jangal Kaudia blocks respectively). After obtaining the village a list of farmer was prepared on the basis of ownership of tractor, pump set and sprayer and use of seed, fertilizer and herbicides, 20 farmer from each village were selected randomly, thus a sample of 120 farmers was obtain. Descriptive statistical tools were used.

RESULTS AND DISCUSSION

Pre-purchase Behavior of Farmers: Pre-purchase behaviours includes the understanding of a set of the division viz. what, why, when, how, where, how much and how often farmers are related to the products. In this section the variables like market search of farmers, decision maker in the family, motivation towards purchase, awareness about the goods, sources of awareness, etc.

It is evident from Table 1 that mother in the farming household has role in the purchase of Seed, however, father play major role in decision making of seed purchase followed by joint decision by mother and father as well ashead of family. Father and head of family has also good say in decision making of seed purchase.

In case of fertilizer, the head of family played major role in purchase decision making in Pratapgarh district along with father. However, in Jaunpur and Gorakhpur districts, father is the main decision maker as well as children. In herbicides purchasing, mothers are not taking any decisions. In the case of fertilizer and pesticide were taken purchase decision mainly by father in family. In the decision taken by mother for purchase of herbicides either negligible or least, in Gorakhpur and Pratapgrah district.

With respect to seed, purchase decision taken by father 27.5, 38, and 23 percent in Jaunpur, Gorakhpur and Pratapgrah district respectively. The fertilizer purchase decision taken by father was estimated to be 42.5, 30.00, and 18 percent in the case of Jaunpur, Gorakhpur, and Pratapgrah district, respectively. This was followed by joint decision taken by father and mother came out to be 20.00, 18, and 15 percent in above said districts, respectively.

A comparison of the selected three Districts revealed certain similarities and differences. It can be observed that the decision maker on purchase is almost similar in the case of Gorakhpur and Pratapgrah district.

The perusal of Table 2 clearly shows that the all the farmers of Jaunpur, Gorakhpur, and Pratapgarh district were aware of branded fertilizers (100 percent). However, for seed, the farmers of the Jaunpur were more (75.00 percent) aware of about branded seed and the farmers in Gorakhpur were more (80.00 percent) aware of branded items followed by non-branded/ home Made items (20.00 percent). Whereas in Pratapgarh district majority (60.00 percent) of them were aware of brand items of seed followed by non-branded/ home-made items (40.00 percent).

With regards to the herbicides, the farmers of the Jaunpur district were more (60.00 percent) aware of non-branded/home-made items followed by branded items

(40.00 percent) and the farmers in Gorakhpur district were more (70.00 percent) aware of non-branded/ home-made items followed by branded items (30.00 percent). Whereas in Pratapgarh district majority (55.00percent) of them were aware of non-branded/ home-made items followed by branded items (45.00 percent).However, in case of herbicide, as more than 50 percent of farmers of all district preferred local/non-branded inputs, due to low cost and other factors which prompted them to use local herbicides were equally effective, easy availability and reliability, etc.

Padmanaban & Sankarnarayanan (1999) Similar study found that the brand loyalty, which revealed that the price of the preferred brand and influence of advertisement significantly influenced the brand loyalty. Only when the price of a particular brand is comparatively low, the farmers would naturally prefer to low priced brand. Otherwise, farmers would naturally continue to purchase the same brand.

The perusal of Table 3 revealed that the farmers of the Jaunpur district had a good sources of awareness about the brands of non-durable seed inputs through Retailer (35.00 percent) followed by Neighbours (30.00 percent each), KVK (18.00 percent), Radio/mobile (12.50 percent), Television (10.00 percent), and Print media (5.00 percent). In Gorakhpur district, the farmers had a good sources of awareness through Neighbours (30.00percent) and (30.00 percent) followed by Television (15.00 percent), Print media (12.50 percent), and KVK (7.5 percent each) and Radio/mobile (5.0 percent).Whereas in Pratapgarh district, the farmers had a good sources of awareness through Retailer (40.00 percent each) followed by Neighbours (20.00 percent), Radio (7.50 percent), Print media (5.00 percent) Television (5.00 percent), and KVK (20.00 percent each).

With regards to fertilizers, the farmers of the Jaunpur district had a good sources of awareness about the brands through Retailer (30.00 percent) followed by Neighbours (20.00 percent), Radio/mobile (18.00 percent), Television (12.50 percent), Print media and KVK (10.00 percent

Table 1. Pre-purchase decision making in family for non-durable inputs

(n=40)

Particular	Jaunpur (n_1=40)			Gorakhpur (n_2=40)			Pratapgrah (n_3=40)		
	Seed	Fertilizer	Herbicide	Seed	Fertilizer	Herbicide	Seed	Fertilizer	Herbicide
Only Father	11 (27.5)	17 (42.5)	22 (55)	15 (38)	12 (30)	17 (43)	9 (23)	7 (18)	15 (37.5)
Only Mother	3 (7.5)	2 (5)	0	4 (10)	1 (2.5)	2 (5)	4 (10)	3 (7.5)	2 (5)
Only head of family	8 (20)	3 (7.5)	6 (15)	10 (25)	7 (18)	5 (13)	6 (15)	11 (28)	8 (20)
Father and Mother	7 (18)	8 (20)	4 (10)	2 (5)	7 (18)	6 (15)	8 (20)	6 (15)	3 (7.5)
Head of family and Father	8 (20)	4 (10)	5 (13)	5 (13)	9 (23)	8 (20)	8 (20)	7 (18)	8 (20)
Head of family and Mother	3 (7.5)	6 (15)	3 (7.5)	4 (10)	4 (10)	2 (5)	5 (13)	6 (15)	4 (10)
Percent	100	100	100	100	100	100	100	100	100

Figures in parentheses denote the percentage.

Table 2. Brand Awareness among farmers

Particular	Jaunpur (n_1=40)		Gorakhpur (n_2=40)		Pratapgrah (n_3=40)	
	Branded	Non-branded/home made	Branded	Non-branded/home made	Branded	Non-branded/home made
Seed	30 (75)	10 (25)	32 (80)	8 (20)	24 (60)	16 (40)
Fertilizer	40 (100)	-	40 (100)	-	40 (100)	-
Herbicide	16 (40)	24 (60)	12 (30)	28 (70)	18 (45)	22 (55)

Figure in parentheses denote the percentage.

each). In Gorakhpur district, the farmers had a good sources of awareness through Retailer (37.5 percent) followed by Neighbours (25.00 percent), Radio (15.00 percent), Television (10.00 percent) and Print media (7.50 percent). Whereas in Pratapgarh district, the farmers had a good sources of awareness through Retailer (38.00 percent) followed by Neighbours (25.00 percent), Radio, Television and KVK (10.00 percent each), and Print media (7.50 percent).

With regards to herbicides, the farmers of the Jaunpur district have a good sources of awareness about the brands through Neighbours (25.00 percent) followed by Television (23.00 percent), Retailer (20.00 percent), KVK (15.00 percent), Radio (10.00 percent) and Print media (7.50 percent). In Gorakhpur, the farmers had a good sources of awareness through Neighbours (28.00 percent) followed by Retailer (25.00 percent), KVK (20.00 percent), Television (15.00 percent), Print media (7.50 percent) and Radio (5.00 percent). On the other hand the farmers had a good sources of awareness through Retailer (32.50 percent) followed by KVK (30.00 percent), Neighbours (20.00 percent), Television (7.50 percent), Print media and Radio (5.00 percent each) in Pratapgarh.

For Jaunpur district, Neighbours play significant role as a source of awareness about brands in market. Likewise, for Gorakhpur district, Retailer and Neighbours work to disseminate information about brands available, etc. also for Pratapgarh district, Retailer play momentous role in advertise on propagate the brand of non-durable inputs.

Purchase Behavior of Farmers: Behaviour of rural consumer at the time of purchase of consumer durables and non-durables was done with respect to the indicators like the possession of the durables and non-durables, source of purchase, mode of purchase, brand choice, reason behind the brand, etc.

The perusal of the Table 4 reveals that majority of the farmers (32.50 percent) of the Jaunpur district, purchase the seed in loose form followed by packed form (67.50

Table 3. Sources of awareness about the brands of non-durables inputs

Particular	Jaunpur (n_1=40)			Gorakhpur (n_2=40)			Pratapgrah (n_3=40)		
	Seed	Fertilizer	Herbicide	Seed	Fertilizer	Herbicide	Seed	Fertilizer	Herbicide
Print media	2 (5)	4 (10)	3 (7.5)	5 (12.5)	3 (7.5)	3 (7.5)	3 (7.5)	3 (7.5)	2 (5)
Radio/mobile	5 (12.5)	7 (18)	4 (10)	2 (5)	6 (15)	2 (5)	3 (7.5)	4 (10)	2 (5)
Television	4 (10)	5 (12.5)	9 (23)	6 (15)	4 (10)	6 (15)	2 (5)	4 (10)	3 (7.5)
Retailer	14 (35)	12 (30)	8 (20)	12 (30)	15 (37.5)	10 (25)	16 (40)	15 (38)	13 (32.5)
Neighbour	12 (30)	8 (20)	10 (25)	12 (30)	10 (25)	11 (28)	8 (20)	10 (25)	12 (30)
KVK and government	7 (18)	4 (10)	6 (15)	3 (7.5)	2 (5)	8 (20)	8 (20)	4 (10)	8 (20)
Percent	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Figures in parentheses denote the percentage.

Table 4. Forms of purchase of selected non-durables in different districts

Particular	Non-durable	Loose form/not used		Packed form	
		Number	Percent	Number	Percent
Jaunpur (n_1=40)	Seed	13	32.50	27	67.50
	Fertilizer	10	25.00	30	75.00
	Herbicide	10	25.00	30	75.00
Gorakhpur (n_2=40)	Seed	18	35.00	26	65.00
	Fertilizer	10	25.00	30	75.00
	Herbicide	8	20.00	32	80.00
Pratapgrah (n_3=40)	Seed	12	30.00	28	70.00
	Fertilizer	12	30.00	28	70.00
	Herbicide	14	35.00	26	65.00

percent). In Gorakhpur, the farmers had purchased the seed in packed form (65.00 percent) followed by loose form (35.00 percent). It was found that the farmers had purchased in packed form (70.00percent) followed by loose form (30.00 percent) to the purchase of seedin Pratapgarh.

With regards to fertilizers, the farmers of the Jaunpur purchased in packed form (75.00percent) followed by loose form (25.00 percent). In Gorakhpur, the farmers had purchased in packed form (75.00percent) followed by loose form (25.00 percent). On the other hand, the 70.00 percent of the farmers had purchased fertilizer in the packed form which was followed by loose form (30.00percent) in Pratapgarh district.

With regards to Herbicides, the farmers of the Jaunpur purchased in packed form (75.00 percent) and remaining (25.00 percent) not used any herbicide. In Gorakhpur, 80 percent of the farmers had purchased in packed form and remaining 20 percent have not used any herbicide. Whereas in Pratapgarh, the 65 percent of the farmers had purchased in packed and remaining (35.00 percent) not used herbicide in production of wheat and rice.

In all three districts, seed, pesticide, and fertilizer are mainly purchased by farmer in packed form.

The data from the Table reveals that majority (55.00 percent) of the farmers of the Jaunpur purchase the seed from Retailer/Dealer followed by Godown / Government Plant Protection Poffice (35.00 percent) and the remaining 10 percent from KVK/ Extension Facilities. In Gorakhpur, the farmers had purchased from Godown / Government Plant Protection Office (57.50 percent) followed by Retailer/ Dealer (37.50 percent) and the remaining 10 percent from KVK/ Extension Facilities. It was found that 75 percent of the farmers had purchased from Retailer/ Dealer followed by Godown and the KVK/Extension Facilities (15.00 percent each) in Pratapgarh.

With regards to fertilizers, 60 percent of the farmers of Jaunpur have purchased from Retailer/Dealer and the remaining 40 percent from Godown/Government Plant Protection Office. In Gorakhpur, the farmers had purchased from Godown/Government Plant Protection Office (75.00 percent) followed by Retailer/Dealer (25.00 percent). Whereas in Pratapgarh, 62.50 percent of farmers had purchased from Village Town/ Retail shop followed by Godown/Government Plant Protection Office (32.50 percent) and the KVK/Extension Facilities (5.00 percent).

With regards to Herbicides, 75 percent of the farmers of Jaunpur have purchased from Retailer/ Dealer and the remaining 1 percent from Godown / Govt. Plant Protection office. In Gorakhpur, the farmers have purchased from Retailer/ Dealer (75.00 percent) followed by Godown / Government Plant Protection Office and KVK/ Extension Facilities (12.50 percent each). Whereas in Pratapgarh, 70 percent of farmers have purchased from Retailer/Dealer followed by Godown/Government Plant Protection Office and KVK/Extension Facilities (15.00 percent each).

The perusal of the Table 6 reveals that 82.5 percent of the farmers of Jaunpur purchased the seed by cash and the remaining 17.5 percent have purchased through credit/ Installment. In Gorakhpur, 75 percent of the farmers of Jaunpur purchased the seed by cash and the remaining 15 percent have purchased through credit/ Installment. Whereas in Pratapgarh, 70 percent of the farmers of Jaunpur purchased the seed by cash and the remaining 30 percent have purchased through credit/ Installment

With regards to fertilizers, 80 percent of the farmers of Jaunpur purchased the seed by cash and the remaining 20 percent have purchased through credit/ Installment. In Gorakhpur, 90 percent of the farmers of Jaunpur purchased the seed by cash and the remaining 10 percent have purchased through credit/ Installment. Whereas in Pratapgarh, 65 percent of the farmers of Jaunpur purchased the seed by cash and the remaining 35 percent have purchased through credit/ Installment.

With regards to Herbicides, 85 percent of the farmers

Table 5. Sources of purchase of selected consumer non-durables inputs

Particular	Jaunpur (n_1=40)			Gorakhpur (n_2=40)			Pratapgrah (n_3=40)		
	Seed	Fertilizer	Herbicide	Seed	Fertilizer	Herbicide	Seed	Fertilizer	Herbicide
Retailer/ dealer	22 (55)	24 (60)	30 (75)	15 (37.5)	10 (25)	30 (75)	30 (75)	25 (62.5)	28 (70)
Godown / Government Plant Protection Office	14 (35)	16 (40)	8 (15)	23 (57.5)	30 (75)	5 (12.5)	8 (20)	13 (32.5)	6 (15)
KVK/ Extension facilities	4 (10)	-	-	4 (10)	-	5 (12.5)	2 (5)	2 (5)	6 (15)
Percent	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Figures in parentheses denote the percentage.

of Jaunpur purchased the seed by cash and the remaining 15 percent have purchased through credit/ Installment. In Gorakhpur, 95 percent of the farmers of Jaunpur purchased the seed by cash and the remaining 5 percent have purchased through credit/ Installment. Whereas in Pratapgarh, 75 percent of the farmers of Jaunpur purchased the seed by cash and the remaining 25 percent have purchased through credit/Instalment. This shows that farmer are risk averse and do not want to take credit/loan for the purchase of inputs. They prefer cash as a mode of payment.

Post Purchase Behaviour: The behavior of a consumer after purchasing a product regarding the use of the product is indicated in terms of satisfaction and shifting of brand. This behavior reflected in repeat purchase and farmers some time develop post purchase decision.

The perusal of results Table 7 reveal that 35 percent of the farmers of Jaunpur shifted their brand because of non-availability of the seed, 30 percent shifted because of high price, 25 percent shifted because of low quality, and 15 percent shifted because of trailing the new brand. In Gorakhpur, 35 percent of the farmers shifted their brand because of high price, 35 percent shifted because of non-availability of the seed and trailing the new brand, 25 percent shifted because of low quality. Whereas in Pratapgarh, 50 percent of the farmers shifted because of high price and trailing the new brand, 37.5 percent shifted their brand because of non-availability of the seed, and 12.5 percent shifted because of low quality.

With regards to fertilizers, all the farmers from three districts namely, Jaunpur, Gorakhpur and Pratapgarh, all the farmers had shifted their brands.

With regards to Herbicides, 37.5 percent of the farmers of Jaunpur district shifted their brand because of high price, 25 percent shifted because of low quality, 15 percent shifted because of non-availability of the seed and 10 percent shifted because of trailing the new brand. In Gorakhpur, 45 percent of the farmers shifted because of high price, 30 percent shifted because of low quality, and 50 percent shifted because of non-availability of the seed and trailing the new brand. Whereas in Pratapgarh, 32.5 percent of the farmers shifted because of high price, 30 percent shifted their brand because of non-availability of the seed, 22.5 percent shifted because of trailing the new brand and, 15.00percent shifted because of low quality.

SUMMARY AND CONCLUSIONS

Purchase decision is mainly affected by purchasing power/ availability of capital with the farmers. It was

Table 6. Mode of payments of sample household

Particular	Non-durable	Cash		Credit/Installment	
		Number	Percent	Number	Percent
Jaunpur (n_1=40)	Seed	33	82.50	7	17.50
	Fertilizer	32	80.00	8	20.00
	Herbicide	34	85.00	6	15.00
Gorakhpur (n_2=40)	Seed	30	75.00	10	15.00
	Fertilizer	36	90.00	4	10.00
	Herbicide	38	95.00	2	5.00
Pratapgrah (n_3=40)	Seed	28	70.00	12	30.00
	Fertilizer	26	65.00	14	35.00
	Herbicide	30	75.00	10	25.00

Table 7. Reasons for shifting the brands of non-durables input

Particular	Jaunpur (n_1=40)		Gorakhpur (n_2=40)		Pratapgrah (n_3=40)	
	Seed	Herbicide	Seed	Herbicide	Seed	Herbicide
Low quality/Production	8 (20)	10 (25)	6 (15)	12 (30)	5 (12.5)	6 (15)
High price	12 (30)	15 (37.5)	10 (25)	18 (45)	10 (25)	13 (32.5)
Non-availability	14 (35)	6 (15)	7 (17.5)	5 (12.5)	15 (37.5)	12 (30)
New brand trial/New variety	6 (15)	4 (10)	7 (17.5)	5 (12.5)	10 (25)	9 (22.5)
Percent	100.00	100.00	100.00	100.00	100.00	100.00

Figures in parentheses denote the percentage.

found that non-durable inputs such as seed, herbicide and fertilizer father in the family were found to be the main decision maker while in case of seed head of family and mother also played significant role in decision making. Retailer was reported as major sources of information for seed, fertilizer ,and herbicide followed by neighbour. Only in case of herbicide, farmer preferred local/non-branded material but for seed and fertilizer, they purchased branded input. In all three districts, seed, herbicide, and fertilizer are mainly purchased by farmer in packed form. farmers preference towards different sources of purchase revealed that for majority of the farmers preferred retail stores and only few farmers preferred either KVK or govt. godown shops. Retail stores are providing credit facility to the farmers and they are located nearby the village. For the post-purchase decision the reasons for shifting the brands of non-durables inputs, it was found that high price, non-availability and low quality of inputs are the main factor affect the post-purchase decision.

The Government should ensure timely availability of seed and fertilizer at Govt. godown. Young generation equipped with modern ICT should be encouraged in inclusive decision making.

REFERENCES

Agrawal, G. (2016).*A study on farmers buying behavior for tractors in Jashpur district of Chhattisgarh* (M.B.A., ABM Project Report)., Department of agri-business and rural management college of agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh.

Babu, S.C., Joshi, P.K., Glendenning, C.J., Asenso Okyere, K., & Rasheed, S.V. (2013). The state of agricultural extension reforms in India: Strategic priorities and policy options. *Agricultural Economics Research Review, 26*(2), 159-172.

Girabi, F., & Mwakaje, A.E.G. (2013). Impact of microfinance on smallholder farm productivity in Tanzania: The case of Iramba district. *Asian Economic and Financial Review*, *3*(2), 227-242.

Goyal, A. (2010). Information, direct access to farmers, and rural market performance in central India. *American Economic Journal: Applied Economics*, *2*(3), 22-45.

Kool, M. (1994).*Buying behaviour of farmers*. Wageningen, Netherlands: Wageningen Pers.

Padmanaban, N.R., & Sankaranarayanan, K., (1999). Business experience, product lines of dealers and farmers loyalty to dealer for pesticides in southern Tamil Nadu. *Indian Journal of Agricultural Marketing* ,*13*(3), 69-74.

Swaminathan, M. (1991). Segmentation, collateral undervaluation, and the rate of interest in agrarian credit markets: Some evidence from two villages in south India. *Cambridge Journal of Economics*, *15*(2), 161-178.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 444-450
DOI: 10.5958/2322-0430.2018.00094.X

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Photovoltaic Water Pumping System: Farmers' Knowledge and Attitude of Hisar District in Haryana State

Anil Kumar[1], Ashok Kumar Godara[2] and Jitender Kumar Bhatia[3]

[1]*Manager, Haryana State Co-operative Supply, and Marketing Federation Limited,, Jain College Road, Ambala City-134 003*
[2]*Professor, Department of Extension Education, and*[3]*Assistant Professor, Department of Agricultural Economics*
CCS Haryana Agricultural University, Hisar-125004

[*]*Corresponding author's email: anilkhas1974@gmail.com*

Received: January 07, 2018 *Manuscript Number: NS-18-07* *Revision Accepted: March 02, 2018*

ABSTRACT

The study was conducted in purposively selected Hisar districts of Haryana state (India) with selected 61 number of Photovoltaic Water Pumping System (PWPS) adopted farmers from this district, and an equal number of non-beneficiaries adjoining to the beneficiaries' farm were also selected. In this way a total number of 122 respondents i.e. 61 beneficiaries and 61 non-beneficiaries were included in the sample for the study. A significant majority of respondents two third (67.21 percent) had medium level of technical knowledge, general knowledge (73.77 percent) and overall knowledge (70.49 percent) by the adopted respondents. In the case of non-adopted respondents, as high as (81.96 percent), had low level of technical knowledge general knowledge (70.49 percent) and three-fourths of farmers (72.13 percent) overall knowledge. Majority of respondents 60.65 and 45.90percent had favorable attitude in the case of adopted and non-adopted, respectively. Landholding, education, socio-economic status, extension contact, source of income, risk orientation and change proneness were found to have positive and significant correlation ship. However, in the case of non-adopted farmers' socio-economic status and risk orientation were found to have positive and significant correlation. The regression coefficient of adopted farmers' Landholding, education, socio-economic status, extension contact, source of income, risk orientation were found to have positive and significant regression coefficient. However, in the case of non-adopted farmers, In the case of non-adopted farmers, socio-economic status and extension contact had positive and significant regression coefficient with the farmers' knowledge level.

Keywords
Attitude, knowledge, photovoltaic water pumping system.

JEL Codes
D71, D82, P28.

INTRODUCTION

Energy is essential for each and every living organism. It has always been the key to man's greatest goals and to his dream of better world. The history of solar energy utilization is so shrouded in antiquity that it is difficult to know the facts. The escalating price of oil since 1973 and its possible shortage has fuelled interest in the development of alternative energy sources such as solar energy. The development of solar energy applications is aimed primarily in the rural areas owing to a special feature of cost-effectiveness as compared to conventional fuel. The factual position is that 85 percent of the world power consumption goes to the rich and only 15 percent goes to the 2.4 billion poor people. The population of India is increasing day by day. It has direct impact on ever-increasing problems of food, fertilizer and energy consumption (fuel). Therefore, the need for developing renewable sources of energy has become necessary as the existing fossil fuel resources are fast depleting. Haryana State Energy Development Agency (HAREDA) has undertaken the task of popularizing the use of solar energy in the state. It is also supplying photovoltaic water pump to the farmers with subsidy, which is compensated from the funds of ₹2, 68,000

received from Ministry of Non-Conventional Energy Sources, Government of India, on a 2 HPDC Monobloc pump of 1800 watt. In a solar PV water pumping system, PV modules convert sunlight directly into electricity and this energy can be used to run an electric motor pump set for pumping water. Photovoltaic-based water pumping system is eco-friendly in nature and pollution-free technology can be more appropriate to the needs of the developing countries like India than solar/thermal energy conversion (STEC). Keeping all these points in mind the present study was undertaken to assess the farmers' knowledge and attitude regarding photovoltaic water pumping system.

OBJECTIVES AND METHODOLOGY

The study was conducted in purposively selected Hisar districts of Haryana state (India). In this district, the highest number of farmers has adopted Photovoltaic Water Pumping Systems. A list of all the beneficiaries of Photovoltaic Water Pumping System, who have installed this system at their farm up to March 2003, was prepared. All the beneficiaries from Hisar (61) were included in the sample and an equal number of non-beneficiaries adjoining to the beneficiaries' farm were also selected. In this way a total number of 122 respondents, that is, 61 beneficiaries and 61 non-beneficiaries were included in the sample for the study. The data were collected through pre-tested structured interview schedule from the respondents to assess the knowledge and attitude towards PWPS.

FINDINGS AND DISCUSSIONS

The socio-economic characteristics of adopted and non-adopted respondents of photovoltaic water pumping system (PWPS) of Hisar district are presented in Table 1.

Age: Majority 54.10 percent of adopted farmers belonged to middle age group (36-50 years) and 31.15 percent of the adopted farmers' belonged to young age group (below 36 years) whereas 14.75 percent of the adopted farmers were in the old age group (above 50 years) in Hisar district. In the case of non-adopted farmers, it was found that 49.18 percent of farmers fell in the middle age group (36-50 years) followed by 39.34 and 11.48 percent by young and old age group (below 36 years) and (above 50 years) in the same district respectively.

Land Holding: Majority of respondents 77.05, 13.12, 9.83 percent had got 5 to 15 acres, less than 5 acres and more than 15 acres land holdings in adopted respondents of PWPS in Hisar district. In the case of non-adopted, In the same district maximum of respondents 63.93, 31.15, and 4.92 percent had got 5 -15 acres, less than 5 acres, and more than 15 acres land holdings respectively.

Education: Maximum number of farmers 81.96 percent was educated up to matric and +2 levels. It was followed by 11.48 percent adopted farmers who were only literate and 3.28 percent farmers were graduates and above. Farmers 3.28 percent were illiterate in the adopted group of Hisar district. In the case of non-adopted group, maximum farmers 72.14 percent were educated up to matric and +2 levels. It was followed by 18.03 percent illiterate farmers and 9.83 percent literate farmers. None of the farmers was graduate and above in the same district (Table 1).

Socio-Economic Status: Maximum farmers of adopted group 95.09 percent had medium socio-economic status. Further, 4.91 percent had high and none of farmers had low socioeconomic status in Hisar district. In the case of non-adopted, maximum farmers, 81.96 percent were of medium socio-economic status. Further, 16.39 and 1.65 percent had low and high socio-economic status in the same district respectively.

Extension Contact: Maximum farmers of adopted group 52.46 percent had medium level of extension contact. Further 44.26 and 3.28 percent had low and high extension contact in Hisar district respectively. In the case of non-adopted, maximum farmers 62.3 percent had low-level extension contact. Further 37.7 percent had medium and none of the farmers had high extension contact level in same district respectively.

Irrigation Facilities: Maximum farmers of adopted group 100.00 percent had tubewell for irrigation facilities. Further, 29.5 percent had canal and 29.5 percent had both tubewell as well as canal irrigation facilities in Hisar district. In the case of non-adopted maximum farmers, 65.57 percent were having tubewells for irrigation facilities. Further, 34.42 percent had canal and 19.67percent had both tubewell as well as canal irrigation facilities in same district respectively (Table 1).

Knowledge of Farmers' Regarding Photovoltaic Water Pumping System (PWPS)

This section is concerned with the farmers' knowledge about various aspects i.e. technical knowledge, general knowledge and overall knowledge about PWPS. The aspect wise knowledge has been presented and discussed in this section.

Farmers' knowledge level regarding PWPS

The distribution of adopted and non-adopted respondents according to their technical knowledge level of PWPS is presented in the Table 2. The Table showing that maximum number of respondents 67.21 percent fell under medium technical knowledge, whereas 18.04 and 14.75 percent respondents had high and low technical knowledge level of Hisar district. In the case of non-adopted farmers, maximum number of respondents 81.96 percent fell under low technical knowledge whereas 18.04 percent of respondents had medium level of technical knowledge. No single farmer had high level of technical knowledge in the same district.

The distribution of adopted and non-adopted, according to general knowledge, has been shown in the Table1, which shows that maximum number of adopted farmers 73.77 percent belonged to medium level of general knowledge. Further, 22.96 percent farmers belonged to high level of general knowledge, whereas 3.27 percent farmers were having low level of general knowledge of adopted group in Hisar district. In the case

of non-adopted, maximum number of farmers 70.49 percent belonged to low level of general knowledge (Table 2). Further, 29.51 percent farmers belonged to medium level of general knowledge. None of the farmers belonged to high level of general knowledge in the same district.

The perusal of Table 2 showed that maximum number of adopted respondents 70.49 percent fell under medium overall knowledge group, whereas 22.96 and 6.55 percent respondents had high and low overall knowledge level respectively in Hisar district. In the case of non-adopted farmers, maximum number of respondents 72.13 percent fell under low overall knowledge group, whereas 27.87 percent farmers had medium level of overall knowledge. None of single farmers had high level of overall knowledge in the same district.

If we compare the technical knowledge level of both the adopted and the non-adopted, it was found that there was very large difference between technical knowledge levels of the two types of respondents regarding PWPS. This was because of the fact that when the farmer installed the PWPS on his farm, some technical points were told by the installer at that time like SPV panel rotation with the movement of sun and the cleaning of SPV panel being essential and therefore, PWPS adopted farmers were well aware about the daily operation of it. The low level of

Table 1. The socio-economic characteristics of adopted and non-adopted respondents of photovoltaic water pumping system (PWPS) of Hisar district

Variables	Categories	Score Range	Adopted (n_1=61)		Non adopted(n_2=61)	
			Frequency	Percent	Frequency	Percent
Age	Young	Below 36	19	31.15	24	39.34
	Middle	36 to 50	33	54.1	30	49.18
	Old	Above 50	9	14.75	7	11.48
Landholding	Less than 5 acres		8	13.12	19	31.15
	5 to15 acres		47	77.05	39	63.93
	More than 15 acres		6	9.83	3	4.92
Education	Illiterate		2	3.28	11	18.03
	Literate		7	11.48	6	9.83
	Matric and +2		50	81.96	44	72.14
	Graduate and above		2	3.28	0	0
Socio-economic Status	Low	Below 22	0	0	10	16.39
	Medium	22 to 38	58	95.09	50	81.96
	High	Above 38	3	4.91	1	1.65
Extension Contact	Low	Below 9	27	44.26	38	62.3
	Medium	9 to16	32	52.46	23	37.7
	High	Above 16	2	3.28	0	0
Irrigation Facilities	Tube well		61	100	40	65.57
	Canal		18	29.5	21	34.42
	Both		18	29.5	12	19.67

Table 2. Farmers' knowledge level regarding PWPS of Hisar district

Variables	Categories	Score range	Adopted (n_1=61)		Non adopted (n_2=61)	
			Frequency	Percent	Frequency	Percent
Technical knowledge	Low	Below 9	9	14.75	50	81.96
	Medium	9 to 16	41	67.21	11	18.04
	High	Above 16	11	18.04	0	0
General knowledge	Low	Below 10	2	3.27	43	70.49
	Medium	10 to 18	45	73.77	18	29.51
	High	Above 18	14	22.96	0	0
Overall knowledge	Low	Below 18	4	6.55	44	72.13
	Medium	18 to 34	43	70.49	17	27.87
	High	Above 34	14	22.96	0	0

technical knowledge in non-adopted farmers might be due to lack of opportunity to use the PWPS. Hence, the use of PWPS increases the technical knowledge of the respondents. It is recommended that there should a proper repetitive educational campaign for popularizing the PWPS. An effective training package will definitely improve the knowledge level of the farmers. The findings were in conformity with the findings of Sangeetha *et al.* (2013); Parmar *et al.* (2014); Kaur *et al.* (2015); Kumari *et al.* 2015); Pratap *et al.* (2016); Altalb & Filipek (2016); Bashir *et al.* (2017); Rani *et al.*(2017).

Farmers' Attitude towards PWPS of Hisar district

It is evaluated from the Table 3 that majority 60.65 percent of the respondents had favourable attitude. Farmers 22.95 and 16.4 were having neutral and unfavourable attitude respectively towards PWPS in Hisar district. In the case of the non-adopted farmers, maximum respondents 45.9 percent had favourable attitude. Respondents 31.14 and 22.96 were neutral and unfavourable attitude respectively towards PWPS in the same district.

The results regarding the attitude of farmers towards Photovoltaic Water Pumping System (PWPS) of irrigation revealed that a majority of farmers had favourable and positive attitude towards PWPS. The adopted and the non-adopted farmers both understand the importance of PWPS involving one-time investment: no fuel requirement; a better technology than the electricity/diesel water pumping system. This may be due to the fact that the farmers have realized the importance of PWPS which is an improved form of technology for the purpose of irrigation. The findings are in line with the findings of Singh *et al.* (2016); Kumar & Godara (2017); Kalita *et al.* (2017) who had found that maximum number of farmers had favourable attitude.

Coefficient of Correlation between Independent Variables and Farmers' Knowledge Level towards PWPS

To establish association between the background variables of the respondents and their knowledge towards PWPS, the coefficient of correlation was computed the data in this regard was presented in the Table 4. A perusal of correlation coefficients presented in Table 4 indicates that landholding, education, socio-economic status, extension contact, source of income, risk orientation and change proneness were found to have positive and significant relationship at 5 percent level of significance. Higher the level of land holding, education, socio-economic status, extension contact, source of income, risk orientation and change proneness, higher the knowledge of PWPS.

Whereas, age, caste, occupation, house type, social participation, material possession, farm power, family type and fatalism were found to have positive but non-significant relationship with the knowledge of PWPS adopted farmers in Hisar district. In the case of non-adopted farmers, socio-economic status and risk orientation were found to have positive and significant relationship at 5 percent level of significance. Higher the level of socio-economic status and risk orientation, higher will be the knowledge of PWPS. Whereas age, caste, occupation, house type, social participation, land holding, material possession, education, farm power, family type, extension contact, source of income, change proneness

Table 4. Coefficient of correlation between independent variables and farmers' knowledge level towards PWPS of Hisar district

Variables	Coefficient of correlation	
	Adopted	Non-adopted
Age	0.182^{NS}	0.103^{NS}
Caste	0.155^{NS}	0.308^{NS}
Occupation	0.209^{NS}	0.278^{NS}
House type	0.112^{NS}	0.125^{NS}
Social participation	0.118^{NS}	0.111^{NS}
Land holding	0.382^{**}	0.238^{NS}
Material possession	0.341^{NS}	0.170^{NS}
Education	0.364^{**}	0.257^{NS}
Farm power	0.035^{NS}	0.262^{NS}
Family type	0.203^{NS}	0.144^{NS}
Socio-economic status	0.476^{**}	0.407^{**}
Extension contact	0.436^{**}	0.187^{NS}
Source of income	0.359^{**}	0.182^{NS}
Risk orientation	0.414^{**}	0.406^{**}
Change proneness	0.421^{**}	0.194^{NS}
Fatalism	0.211^{NS}	0.171^{NS}

***** Correlation is significant at the 5 percent level.***
NS: Non-significant.

Table 3. Farmers' attitude towards PWPS of Hisar district

Level of attitude	Score range	Adopted (n_1=61)		Non adopted (n_2=61)	
		Frequency	Percent	Frequency	Percent
Favourable	45 to 60	37	60.65	28	45.9
Neutral	29 to 44	14	22.95	19	31.14
Unfavourable	12 to 28	10	16.4	14	22.96

and fatalism were found to be positive but non-significant in the same district.Similar findings were reported by those of Gautam *et al.* (1995);Singh (2001); Singh & De (2003), Patil *et al.* (2005); Ahrmed *et al.*(2013); Kabir (2015); Patel *et al.* (2016); Mistry *et al.* (2016); Kumar *et al* .(2016); Indoria *et al.* (2017).

Contribution between Independent Variables and Farmers' Knowledge Level towards PWPS

In order to determine the contribution of these independent variables influencing the dependent variables (knowledge and attitude) and to explain the total variance from all the variables, the data were further examined by using the multiple regression analysis. A perusal of coefficients of regression presented in Table 5 indicated that landholding, education, socio-economic status, extension contact, source of income and risk orientation were found to have positive and significant regression coefficient whereas age, caste, occupation, house type, social participation, material possession, farm power, family type, change proneness and fatalism were found to have positive but non-significant regression coefficient with the knowledge of PWPS adopted farmers in Hisar district.

The regression coefficient further showed that the entire background variable jointly explained 65 percent variation in the adopted farmers of PWPS. The calculated 'F' value in all the cases was found to be significant at 5 percent level of significance. In other words, one unit change in the level of land holding, education, socio-economic status, extension contact, source of income and risk orientation led to a corresponding change of 0.292, 0.864, 0.664, 0.586, 0.338 and 0.824 units in the knowledge level of PWPS, respectively. In the case of non-adopted farmers, socio-economic status and extension contact were found to have positive and significant relationship at 5 percent level of significance whereas age, caste, occupation, house type, social participation, land holding, material possession, education, farm power, family type, source of income, risk orientation, change proneness and fatalism were found to be positive but non-significant. The regression coefficient further showed that all the background variables jointly explain 53 percent variation in non-adopted farmers of PWPS the calculated 'F' value in all the cases was found to be significant at 5 percent level of significance. In other words, one unit change in the level of socio-economic status and extension contact may lead to a corresponding change of 0.283 and 0.252 units respectively in the knowledge level of PWPS.The findings of the study are in agreement with the findings of Jagnathan *et al.* (2012); Ogunjimi & Farinde(2012): Bhushan*et al.* (2013); Patel & Vajapara (2016); Rojh *et al.*(2016); Kumar *et al.* (2016); Poddar *et al.* (2017) who observed that age, caste, occupation, house type, material possession and farm power had positive but non-significant multiple regression with the knowledge of the respondent.

Table 5. Coefficient of regression between independent variables and farmers' knowledge level towards PWPS of Hisar district

Variables	Coefficient of regression			
	Adopted		Non-adopted	
	b-values	t-values	b-values	t-values
Age	0.32^{NS}	0.203	0.124^{NS}	0.389
Caste	0.196^{NS}	1.727	0.765^{NS}	0.914
Occupation	0.964^{NS}	0.951	0.174^{NS}	0.158
House type	0.775^{NS}	0.535	1.006^{NS}	0.001
Social participation	0.342^{NS}	0.128	0.687^{NS}	0.193
Land holding	0.292**	2.233	0.515^{NS}	0.713
Material possession	0.127^{NS}	0.66	0.302^{NS}	0.111
Education	0.864**	2.477	1.562^{NS}	0.062
Farm power	0.484^{NS}	1.061	0.628^{NS}	0.311
Family type	0.689^{NS}	1.652	1.196^{NS}	0.122
socio-economic status	0.664**	2.238	0.283**	2.239
Extension contact	0.586**	2.453	0.252**	2.257
Source of income	0.338**	2.521	0.61^{NS}	0.438
Risk orientation	0.824**	2.861	0.242^{NS}	0.211
Change proneness	0.402^{NS}	0.162	0.557^{NS}	0.186
Fatalism	0.217^{NS}	0.134	0.689^{NS}	0.242
R^2	0.65		0.53	

***Significant at the 5 percent level.*
NS: Non-significant.

CONCLUSIONS

It can be concluded from the results that majority of the adopted farmers belonged to medium level of technical knowledge, general knowledge, and overall knowledge. In the case of non-adopted farmers, maximum number of respondents fell under low level of technical knowledge, general knowledge and overall knowledge regarding PWPS. There is need to increase knowledge level of non-adopted farmers. Majority of farmers had favourable and positive attitude towards PWPS of both group, that is, adopted and non-adopted.

It was also found that landholding, education, socio-economic status, extension contact, source of income, risk orientation and change proneness were found to have positive and significant relationship at 5 percent level of significance. Whereas, age, caste, occupation, house type, social participation, material possession, farm power, family type and fatalism were found to have positive but non-significant relationship with the knowledge of PWPS adopted farmers. In the case of non-adopted farmers, socio-economic status and risk orientation were found to have positive and significant relationship at 5 percent level of significance. Whereas age, caste, occupation, house type, social participation, land holding, material possession, education, farm power, family type, extension contact, source of income, change proneness and fatalism were found to be positive but non-significant.

SUGGESTIONS AND POLICY IMPLICATIONS

Adopted farmers have medium level of knowledge and non-adopted farmers have low level of knowledge. There is large difference of knowledge level in farmers of adopted and non-adopted groups. Farmers 60.65 percent have favourable attitude and farmers 39.35 percent have either neutral or unfavourable attitude. In order to remove this gap, the following steps are required:

Services of an extension specialist should be available to the farmers for proper knowledge and use of this technology.

Attractive published materials may be used for the dissemination of the technology between the stakeholders.

Exhibitions and extension camps should be organized at block and village level so that farmers can be aware of the technology. This step will increase the knowledge level as well as attitude the farmers.

Initiatives should be taken to develop the new technology applicable in the water table more than 8-meter depth

Benefits of use of PWPS should be telecast, broadcast and there should be advertisement in newspapers so that it can make easy access to the farmers and assure them that use of PWPS needs no fuel charges.

Maximum number of PWPS should be provided on the subsidized.

REFERENCES

Ahrmd, K.Z., & Roy, S.D. (2013). A study on knowledge gain, adoption, and attitude towards training of farm women in Port Blair, Andaman. *Indian Journal of Extension Education, 49*(1&2), 67-72.

Altalb, A.A.T., & Filipek, T. (2016). The knowledge level of farmers towards agricultural extension in lublin province-Poland. *International Journal of Agricultural Extension and Rural Development Studies, 3*(1), 21-29.

Bashir, B.P., Venkatachalapathy, T.R., Valsanlan, J., & Rout, P.K. (2017). Impact of training on knowledge level of goat keepers and new entrepreneurs in Kerala. *Indian Research Journal of Extension Education, 17*(1), 67-70.

Bhushan, B., Malik, J.S., Narwal, R.S., & Chanu, T.M. (2013). Analysis of the factors responsible forthe Adoption of Agricultural Indigenous Technology Practices.(ITP'S). *Agricultural Science Digest, 33*(2), 118-122.

Gautam, D.S., Nahatker, S.B., & Thakur, P. (1995). Socio-economic evaluation of biogas plant owners in Madhya Pradesh. *Bhartiya Krishi Anusandhan Patrika, 9*(4), 274-278.

Indoria, D., Bharti., Solanki, R.L., & Meena, B.S. (2017). Compact study of knowledge level of trained farmers about vegetable cultivation practices. *International Journal of Current Microbiology and Applied Science, 6*(9), 2329-2334.

Jaganathan, D., Bahak, R., Burman, R.R., & Lenin,V. (2012). Knowledge level of farmers on organic farming in Tamil Nadu. *Indian Research Journal Extension Education, 12*(3), 70-73.

Kabir, K.H. (2015). Attitude and level of knowledge of farmers on ICT based farming. *European Academic Research, 2*(10), 13177-13196.

Kalita, R.R., Das, M.D. and Bora, S. (2017). Knowledge, attitude, and practices of farmers vermiculture technology. *Indian Research Journal of Extension Education, 17*(4), 78-92.

Kaur, K.P., Kaur, P., & Dhaliwal, R.K. (2015). Knowledge level of farmers regarding agronomic practices of direct seeded rice in Punjab. *International Journal of Farm Science, 5*(1), 2009-2015.

Kumar, A., & Godara, A.K. (2017). Knowledge and attitude of farmers towards zero-tillage technology in Haryana. *Agricultural Science Digest, 37*(3), 203-208.

Kumar, A., Rani, S., Lal, M., & Bhatia, J. (2016). Knowledge of farmers regarding tomato crop production in Karnal district of Haryana. *Indian Journal of Economics and Development, 12*(1), 197-200.

Kumari, V.K., & Rajan, R.R. (2015). Impact of training on knowledge and adoption level of chawki rearing center owner of Karnataka State. *Agricultural Science Digest, 35*(3), 203-206.

Mistry, J.J., Patel, D.B., and Patel, V.M. (2016). Knowledge level of recommended green gram cultivation technology of tribal FLD farmers. *Gujarat Journal of Extension Education, 27*(1), 53-55.

Ogunjimi, S.I., & Farinde, A.J .(2012). Farmers' knowledge level of Precautionary measures in agrochemical usage on cocoa production in Osun and Edo State Nigeria. *International Journal of Agriculture and Forestry, 2*(4), 186-194.

Parmar, L.B., Vihal, V.P., & Prajapati, M. (2014). Knowledge of vermicompost technology among the tribal beneficiaries of National Agricultural Innovation Project under Component-III in Banaskantha district, Gujarat. *International Journal of Agriculture Extension, 2*(3), 165-168.

Patel, D.B., Mistry, J.J., & Patel, V.M. (2016). Impact of cumin crop field demonstration on knowledge of farmers. *Gujarat Journal of Extension Education, 27*(1), 45-48.

Patel, S.S., & Vejapara, V.P. (2016). Knowledge of ratoon management practices by the sugarcane growers. *Gujarat Journal of Extension Education, 27*(1), 77-78.

Patil, S.J., & Dhongade, M.P. (2005). Economics of gobar gas plants in Ahmed Nagar district of Maharashtra. *Khadigramodyog, 30*(5), 195-198.

Poddar, P.K., Miah, M.A.M., Uddin, M.M., & Dev, D.S.(2017). Conservation agriculture: A farm level practice in Bangladesh. *Agricultural Science Digest, 37*(3), 197-202.

Pratap, J., Sagar, M.P., Chander, M., Khyalia, N.K., & Chaturvedani, A.K. (2016). Scientific knowledge about poultry broiler farming in Barabanki district of Uttar Pradesh. *Indian Journal of Extension Education, 52*(3&4), 183-187.

Rani, S., Varma, S.K., Yadav, V.P.S., & Lal, M. (2017). Gain in knowledge of rural women regarding selected vegetable cultivation practices through media package in Hisar district of Haryana. *Indian Research Journal of Extension Education, 17*(1), 44-52.

Rojh, R., Ram, H., Sharma, S.K., & Prasad, D. (2016). Knowledge and adoption of improved cultivation: Practices of groundnut by the farmers of Bikaner district of Rajasthan. *Indian Journal of Extension Education, 24*, 108-110.

Sangeetha, S., Ganesan, R., & Sridhar, P.J. (2013). Study on the knowledge level of farmers on tomato cultivation under precision farming. *Agricultural Science Digest, 33*(4), 284-288

Singh, A.K., & De, D. (2003). Constraints analysis in adoption of biogas technology. *Journal of Interacademicia, 1*(2), 137-144.

Singh, A.K., Singh, D., Singh, A., Singh, A., Singh, M., & Kumar, A. (2016). Knowledge and attitude of farmers towards raised bed and other improved production technology of pigeonpea (*Cajanus Cajan*) for climate resilient agriculture. *Indian Research Journal of Extension Education, 52*(3&4), 135-140.

Singh, R. (2001). Problems and prospectus of biogas technology in south-west Maharashtra. *Maharashtra Journal of Extension Education, 17 ,*47-51.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 451-456
DOI: 10.5958/2322-0430.2018.00095.1

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Educational Status of Rural Youth in Sangrur District of Punjab

Mehak Jain[1], Simran Kang Sidhu[2] and Shalini Sharma[2]*

[1]Research Scholar and [2]Professors of Sociology, Department of Economics and Sociology
Punjab Agricultural University, Ludhiana-141004

[*]Corresponding author's email: mehakjain-aes@pau.edu

Received: January 15, 2018 *Manuscript Number: NS-18-79* *Revision Accepted: March 14, 2018*

ABSTRACT

The proposed study is an effort to study rural youth with the objective to find out the educational status of rural youth, their dropout rate and the reasons for dropout. The study was conducted in Balewal village of Sangrur district by interviewing all the young persons in the village having age between 15-35 years. Sample size was 281 respondents (136 males and 145 females). The findings of the study revealed that 68 percent of the respondents had education up to school level only and out of these a half could not make it to higher secondary level. The reasons for drop out at various levels were either due to lack of use of education as perceived by youth followed by expensive education and inability to get admission in college due to poor academic performance. The study concluded that high quality education leading to occupational opportunities may solve many problems confronted by rural youth.

Keywords
Education, employment, Punjab, rural youth

JEL Codes
C81, I20, I21, I23.

INTRODUCTION

Youth being vibrant, dynamic, innovative and enthusiastic in nature is the most powerful section of population. Attributes of strong passion, motivation, and willpower make them the most valuable human resource for fostering economic, cultural and political development of a nation. Proper care and attention paid to youth's physical, mental and social development helps them to grow into well informed, useful and responsible citizens.

Youth as a demographic construct have both biological and sociological specificities. Biologically, it refers to the stage of life of human beings passing through between childhood and adulthood. But, sociologically it is not only a stage of life but a category for analyses which further divides into sub-categories of early youth, middle youth and late youth. While biological specificities like age, puberty, temprament, etc. are found in all the individuals irrespective of type of society, sociological specificities like role, status, expectations and aspirations vary from society to society. Each nation has its own criteria to define youth according to its culture and needs of its youth. United Nations Organization (UNO) defines youth as all persons in the age group between 15-24 years. The India Ministry of Youth Affairs and Sports, which is the nodal ministry dealing with youth concerns defines youth as the population lies between the age group of 15-35 years. However, in 2014, National Youth Policy modified it and redefined youth as all persons in the age-group of 15-29 years (Verma *et al.,* 2017). The size of youth population in a country determines its ability and potential for growth.

India is the young nation in the sense that share of its youth in total population in 2011 stands at 34.8 percent. It has provided great opportunity for the country to reap this demographic dividend for making rapid economic growth. Development of youth as a responsible citizen demands for better education, employment driven training and brighter future. It is the responsibility of the state to provide skill based education and job placements for all its graduates. However presently, education and employment are the two major issues confronted by almost every young one in India. Youth unemployment in India is on rise. According to the World Development

Report 2013, nine percent of males and 11 percent females aged between 15 to 35 years are unemployed. Among them, young graduates from urban areas suffer the most as far as getting job is concerned (Verma *et al.,* 2017). Other segment at the disadvantageous position is rural youth who find themselves unfit in the expeditiously changing conventional practices.

In response to globalization, where urban youth have changed accordingly and develop a bicultural or hybrid identity that provides the basis for living in their local culture along with flowing smoothly with the global culture, for rural youth, adapting to the sudden changes taking place in their cultures is more difficult (Singh & Kahlon, 2016). The images, values, and opportunities they perceive as being part of the global culture undermine their belief in the value of local cultural practices. At the same time, due to lack of education, the ways of global culture seem out of reach to them. Instead of being bicultural, they find themselves excluded from both the worlds, that is, their own culture as well as global culture (Arnett, 1998). On one hand, the division of land holdings and decreasing earning in agriculture sector are pushing them to leave their traditional occupations and on the other hand, due to lack of higher education and technical skills, they are unable to compete with their urban counterparts in job markets (Sidhu *et al.,* 2012). They are left with only two alternatives, either to run away from the country or to run away from the situation. Unable to cope up with the situation they either seek to migrate to foreign country (Sharma & Sidhu, 2016) or indulge in drug abuse (Jiloha, 2009). In both the cases, there is a huge wastage of human resource potential. Presently, main streaming rural youth in development process of the country is a big challenge in itself. The need of the hour is to systematically study every aspect of rural youth so that they are able to become part of socio-economic development of the country. Proposed study is an effort in this direction with the objective to find out educational status of rural youth in Punjab.

METHODOLOGY

The study was conducted in Balewal village of Sangrur district. All the young person's having age between 15-35 years residing in the village from the last ten years were taken as respondents. Sample size was 281 respondents (136 males & 145 females). A self-structured interview schedule was formulated to collect data. Age, categorized by early youth (15-18 years), middle youth (19-24 years) and late youth (25-35 years), was taken as dependable variable whereas occupation, level of education, type of school, dropout rate, reasons for dropout were taken as independent variables. The collected data were analyzed by using simple percentages and variations among population was observed through Z-Test. Findings of the study are discussed as under.

RESULTS AND DISCUSSION

Knowledge and education are the key factors for full and effective participation of youth in the processes of social, economic and political development. The data presented in Table 1 show the age wise and gender-wise distribution of respondents. Age wise data show that majority of early youth (89.58 percent) and half of middle youth (46.08 percent) respondents were students whereas half of late youth (48.09 percent) respondents was employed in different professions, that is, agriculture, private service, government service, labour and self-employment followed by middle youth (34.32 percent) and early youth (4.17 percent).

Gender wise analysis show that the number of female students (37.93 percent) was more than males (28.67 percent) and in the case of employment; males (55.16 percent) were more employed than that of females (17.24 percent). Further, it was observed that nearly half (44.83 percent) of female respondents were either homemakers or not employed however 16.17 percent of males were unemployed. The significant difference was found between male and female in the category of employed and not employed, whereas males outnumbered females in the case of employed and for the category of unemployment, females were more in numbers. Among the not employed respondents, majority of the males (48.85 percent) belonged to the category of unemployed whereas majority of females (73.3 percent) were homemakers.

Level of Education

The results of Table 2 indicate that respondents had

Table 1. Age wise and gender-wise distribution of respondents according to their occupational status

(Percent)

Occupational status	Age wise			Total N=281	Gender wise		
	Early youth (n_1= 48)	Middle youth (n_2=102)	Late youth (n_3=131)		Male (n_1=136)	Female (n_2=145)	Z-value
Student	89.58	46.08	3.05	33.45	28.67	37.93	1.60^{NS}
Employed	4.17	34.32	48.09	35.59	55.16	17.24	3.49**
Not employed	6.25	19.60	48.85	30.96	16.17	44.83	3.08**
Unemployed	-	55.00	40.63	45.97	100.00	27.69	0.63^{NS}
Home maker	-	45.00	59.37	54.03	-	72.31	-

***Significant at 5 percent level.*
NS: Non-significant.

different educational levels. Out of the total respondents, 28.82 percent of youth were having education up to senior secondary level, while 20.64 percent of respondents were educated up to matric and an equal number at graduate level. Age wise data found that nearly half of early youth respondents educated up to matric (41.67 percent) and senior secondary (45.83 percent) whereas one fourth of middle (26.47 percent) and late youth (24.43 percent) respondents had educated up to senior secondary level. Further, middle youth (39.21 percent) and late youth (13.74 percent) respondents had education up to graduation level. A very few number of respondents (11.7 percent) had education up to post graduation level.

The comparison between male and female shows that one fourth (25.00 percent) of male respondents and 16.56 percent of female respondents had education up to matric level. The numbers of graduate male respondents were 12.50 percent and female were 28.28 percent, overall 11.74 percent of respondents were postgraduate. A significance difference (Z-value 2.47) was observed in higher education level where females outnumbered males. At graduation level, females were more than double in number (28.28 percent) as compare to male respondents (12.50 percent). On the other side, at school education level the number of male respondents were high than that of the female respondents. Similarly, 30.15percent of male and 27.59 percent of female were educated up to senior secondary level.

Type of School

Today everyone in the country, irrespective of caste, class, region, and religion has acknowledged the role of education in the development of self as well as of the community. There is a provision of free and compulsory education to all children less than fourteen years in all the government schools prevalent in every village or adjoining village in the country. However, the quality of education in government schools, particularly in rural areas is so poor that people, in general, have lost faith in the educational system itself. It is believed that education provided in government schools is worthless and takes students to nowhere (Sidhu & Sharma, 2012). This notion encourages people to choose expensive private schools over government schools for educating their wards. The practice of sending male child to the private school and female to government schools had been prevalent in rural areas since olden days owing to the belief of investing in sons with a hope of returns and neglecting girl child as she was going to others' household (Gill, 2015). Contrary to this belief, the data in Table 3indicates a changing trend in this respect. The females outnumbered males regarding their education in private schools which are generally considered as quality wise better but are costly than government schools. The results given in Table 3show the distribution of respondents according to type of school in

Table 2. Age wise and gender-wise distribution of respondents according to their level of education

(Percent)

Level of education	Age-wise			Total (N=281)	Gender-wise		
	Early youth (n_1= 48)	Middle youth (n_2=102)	Late youth (n_3=131)		Male (n_1=136)	Female (n_2=145)	Z-Value
Illiterate	-	2.94	2.29	2.14	2.95	1.37	0.70^{NS}
Primary	2.08	3.92	8.39	5.70	5.15	6.20	0.49^{NS}
Middle	10.45	3.92	15.27	10.32	13.99	6.90	1.46^{NS}
Matric	41.67	14.70	17.5	20.64	25.00	6.56	1.27^{NS}
Senior Secondary	45.83	26.47	24.43	28.82	30.15	27.59	0.11^{NS}
Graduation	-	39.21	13.74	20.64	12.50	28.28	2.47**
Post-Graduation	-	8.82	18.32	11.74	10.26	13.10	0.85^{NS}

*****Significant at 5 percent level.***
NS: Non-significant.

Table 3. Age-wise and gender-wise distribution of respondents according to their type of school

(Percent)

Type of School	Age Wise			Total N= 275	Gender Wise		
	Early Youth (n_1=48)	Middle youth (n_2=99)	Late youth (n_3=128)		Male (n_1=132)	Female (n_2=143)	Z-value
Government School	79.17	73.73	82.03	78.90	82.57	75.52	0.07^{NS}
Private School	20.83	26.27	17.97	21.10	17.43	24.48	1.49^{NS}

NS: Non-significant.

which they studied or were studying. Out of total respondents, it was found that majority (78.90 percent) of the respondents had their school education from government schools whereas one fifth (21.10 percent) of them went to private schools. Age wise data found that majority of early youth (79.17 percent) and late youth (82.03 percent) respondents had their education from government schools followed by middle youth (73.73 percent) whereas one fourth of middle youth (26.27 percent) and one fifth of early youth (20.83 percent) had their education from private schools.

So far as gender is concerned, majority (82.57 percent) of males and females (75.52 percent) respondents went to government schools and nearly 17.43 percent males and 24.48 percent females went to private school for the reason of non-availability of private school in the village and very less number of people prefers to send their wards in other village for education.

Decision regarding Choice of Subjects at Senior Secondary Level

Choosing the right career path is becoming more and more important for young students today. Subsequently, the foremost decision they have to take is the choice of subjects for further study. The decision making in this regard may be influenced by people around them including parents, peer group or any role model in student life but final decision is taken by the students only. But at the same time, the incidence of forcefully implementing the decision made by parents, elder siblings or teachers regarding choice of subjects for the young ones is not uncommon in India (Ganesh & Magdalin, 2007; Hussain *et al.,* 2008). Table 4 reveals the respondents decision regarding choice of subjects at senior secondary level. Another factor influenced their decision regarding choice of subjects at senior secondary level was peer pressure. Age wise data show that majority of (83.24 percent) youth irrespective of age had their own choice regarding selection of subjects at senior secondary level whereas 12.81 percent of early youth respondents influenced by peer group followed by 7.69 percent middle youth and 8.10 percent of late youth respondents. It was observed that near about nine percent of youth had selected the subjects due to the fact that their friends were selecting those subjects. Following peer group was found to be almost similar among males (8.64 percent) and females (9.09 percent).

Gender wise data found that majority of male (82.72 percent) and female (83.63 percent) respondents said that choice of subjects at senior secondary level was their own decision and were not influenced by others. Further, it was found that 8.64 percent male and 9.09 percent female respondents had chosen their stream under the influence of peer group and few of them were influenced by parents (2.09 percent). It was found that contrary to the above said notion of elders imposing their decision on young ones, parents, and relatives in rural areas did not interfere in the choice of subjects at senior secondary level. No gender wise significant difference was observed.

Dropout at Various Levels of Education

Out of the total of 281 respondents, majority respondents (85.56 percent) dropped their studies at school level only till they reach at the level of senior secondary. The perusal of Table 5 indicates that one third (33.89 percent) of respondents had left their study at senior secondary level out of which 35.87 percent were male and 31.81 percent were female whereas 30 percent respondents dropped their study after passing the matriculation. Among those who left study at matric level, 38.04 percent were males and 21.59 percent were females. Only 13.89 percent and 5.56 percent respondents had left their study at graduate and postgraduate level respectively. Study did not found significant difference between male and female respondents as far as dropping out at various levels was concerned.

Further the age wise data show that 40.00 percent of early youth and 30.28 percent late youth respondents drop their study at matric level followed by one fourth (26.78 percent) of middle youth. Moreover, nearly half (44.64 percent) of the middle youth respondents had left their study at senior secondary level whereas one third (33.34 percent) and more than one fifth (28.44 percent) of early and late youth respondents respectively left their study at

Table 4. Age wise and gender-wise distribution of respondents according to their decision regarding subjects

(Percent)

Decision regarding subjects	Age-wise			Total N=191	Gender-wise		
	Early youth (n_1=39)	Middle youth (n_2=78)	Late youth (n_3=74)		Male (n_1=81)	Female (n_2=110)	Z-value
Own choice	82.05	83.33	83.78	83.24	82.72	83.63	1.93**
Peer Group	12.81	7.69	8.10	8.90	8.64	9.09	0.70NS
Parents	5.12	1.28	1.38	2.09	1.24	2.71	0.49NS
Sibling	-	5.13	1.35	2.61	3.70	1.81	0.43NS
Relatives	-	2.56	5.40	3.14	3.70	2.72	-

Significant at 5 percent level.
NS: Non-significant.

Table 5. Age wise and gender-wise distribution of respondents according to their dropout at various levels of education

(Percent)*

Dropout at various levels of education	Age-wise			Total N=180	Gender-wise		
	Early youth (n_1=15)	Middle youth (n_2=56)	Late youth (n_3=109)		Male (n_1=92)	Female (n_2=88)	Z-value
Primary	-	3.58	9.17	6.67	4.35	9.09	0.99^{NS}
Middle	13.33	7.14	11.01	10.00	13.04	6.81	1.21^{NS}
Matric	40.00	26.78	30.28	30.00	38.04	21.59	1.93**
Senior Secondary	33.34	44.64	28.44	33.89	35.87	31.81	0.64^{NS}
Graduation	13.33	14.28	13.76	13.89	5.43	22.72	1.78^{NS}
Post-Graduation	-	3.58	7.34	5.56	3.26	7.95	1.01^{NS}

***Significant at 5 percent level.*
NS: Non-significant.
Percent exceeds due to multiple responses.

Table 6. Age wise and gender-wise distribution of respondents according to their reasons for not perusing higher education

(Percent)*

Reasons	Age-wise			Total N=180	Gender-wise		
	Early youth (n_1=15)	Middle youth (n_2=56)	Late youth (n_3=109)		Male (n_1=92)	Female (n_2=88)	Z-value
College too far	13.33	5.36	5.50	6.11	2.17	10.23	1.17
College education costly	86.67	94.64	58.71	72.78	90.11	55.68	2.65**
Disbelief in usefulness of education	53.33	60.71	49.54	53.33	61.62	39.77	2.40**
Failure in board examination	26.67	21.43	18.35	20.00	32.61	6.82	2.08**
Pass, but poor academic performance	26.67	14.28	25.69	22.22	19.57	25.00	0.63^{NS}
Got married	-	21.43	9.17	12.22	2.17	22.73	1.33^{NS}
Financial compulsion to earn	-	7.14	3.67	4.44	8.69	-	-

***Significant at 5 percent level.*
NS: Non-significant.
Percent exceeds due to multiple responses.

senior secondary level.

Reasons for Not Pursuing Higher Education

In India today, education is the foremost concern of every parent irrespective of caste, class, creed, religion or region but due to many socioeconomic reasons, they have to leave studies at school level. Table 6 shows the various reasons behind the dropping of education at various levels of school education. Age wise data highlights that 13.33 percent of early youth respondents left their study due to the reason that the was college too far from their residence as compare to middle (5.36 percent) and late youth (5.50 percent) respondents. Majority of early youth (86.67 percent) and middle youth (94.64 percent) respondents were not perusing higher education due to expensive fee structure of colleges whereas 60.71 percent of middle youth respondents and half of early youth (53.33 percent) and late youth (49.54 percent) respondents were not perusing their education due to the disbelief in usefulness of education at all. According to them, there was no relationship between present educational system prevailing in rural areas and employment and uneducated youth had better employment opportunities as compared to educated ones.

Gender wise data found that 72.75 percent respondents did not perusing for higher education due to financial problems out of which majority (90.11 percent) were males and more than half (55.68 percent) were females while half (53.33 percent) of total respondents lost faith in education system a substantial number of respondents (22.22 percent) left studies because they had poor academic results at school level. Females left education as they got married and males once got job due to financial compulsion to earn, did not carried studies further. Overall school related indicators like disinterest in studies, board exam failure, and poor academic performance came out to be the main reason (95.55 percent) for dropping education at various levels of education. Gender wise analyses show that there is

significant difference between males and females regarding above said indicators with males outnumbered females among all the three indicators (Z value, 2.65, 2.40 and 2.08 respectively) related to education.

CONCLUSIONS

The study concludes that high quality education leading to occupational opportunities may solve many problems confronted by rural youth. Being school education as the foundation stone for higher education, there is an urgent need to check quality of education primarily at this level only. Higher education must be affordable for all sections of society irrespective of caste, class, and region. More emphasis should be given on skill oriented education and the more number of employment opportunities must be created for educated rural youth so as to eradicate the situation of discontinuation of studies. If this segment of population is taken care of properly, it can be proved as an asset for social and economic development of the country.

REFERENCES

Arnett, J.J. (1998). Learning to stand alone: The contemporary American transition to adulthood in cultural and historical context. *Human Development,41,* 295-315.

Ganesh, M.P., & Magdalin, S. (2007). Perceived problems and academic stress in children of disrupted and non-disrupted families. *Journal of the Indian Academy of Applied Psychology*, *33*, 53-59.

Gill, M. (2015). Bridging the skills gap through vocational education. *International Journal of Human Resource Management and Research*, *5***,** 1-9.

Hussain, A., Kumar, A., & Husain, A. (2008).Academic stress and adjustment among high school students. *Journal of the Indian Academy of Applied Psychology, 34*, 70-73.

Jiloha, R.C. (2009). Social and cultural aspects of drug abuse in adolescents. *Delhi Psychiatry Journal, 12*, 167-175

Sharma, S., & Sidhu, S. (2016). Human trafficking: A case of deceived aspiring emigrants in Punjab. *Indian Journal of Economics and Development, 12*, 341-346.

Sidhu, S.K., & Sharma, S. (2012). Etiology of rural exclusion in higher education: A case of Punjab. *Indian Journal of Economics and Development, 8,* 71-78.

Sidhu, S.K., Singh, S., Romana, G.S., Singh, B., & Sharma, S. (2012). Qualitative assessment of primary education in Punjab. *Research Journal Social Sciences, 20,* 49-65.

Singh, B., & Kahlon, N. (2016). Changing perceptions of rural youth in Punjab. *Asia Pacific Journal of Research, 1,* 46-51.

Verma, D., Kesan, H.P., Kumar, R., Parkash, C., Kumar, P.S., Sain, M., & Dash, P. (2017). *Youth in India* (pp-2-10). New Delhi: Ministry of Statistics and Programme Implementation.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 457-462
DOI: 10.5958/2322-0430.2018.00096.3

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Changing Dimensions of Women Status in Punjab

Randeep Kaur and Lavleen Kaur[*]

Department of Agriculture, Khalsa College, Amritsar-143001

[*]*Corresponding author's email: gurlavs@yahoo.com*

Received: December 19, 2017 *Manuscript Number: NS-18-25* *Revision Accepted: February 14, 2018*

ABSTRACT

The present study examines the changing Dimensions of women status in Punjab. The study was based on secondary data collected from various government and reputed sources. The study revealed that sex ratio in Punjab improved from 876 in 2001 to 893 in 2011 but it is much less than the national average of 943. Sex Ratio in 0-6 age group has improved but is less than the national average. There has been a marginal improvement in daughter preference over the time from 1992-2007. Female work participation rate (FWPR) has declined by 5.2 percent in 2011 from the previous census. Low female work participation denies women from becoming economically empowered in Punjab. Participation of women employment under MNREGS projects a healthy trend in Punjab. While comparing the life expectancy of Punjab with all India, it is observed that both males and female of Punjab have better life expectancy at 67.4 and 71.6 respectively as compared to 64.6 and 67.8 for national average respectively. The state achieved female literacy rate of 70.7percent which was lower than male literacy of 80.4percent in 2011.Punjab ranked 14th in Human and Gender development indicators (HDI and GDI) among 32 states/UTs but value of GDI was less than HDI indicating low status of women. The reasons for low status of women were various social formations that regulate their lives and the patriarchal setup.

Keywords
Employment, gender, sex ratio, status, women.

JEL Codes
J11, J13.

INTRODUCTION

Historically, position of women in Punjab has not been satisfactory. High level of economic and infrastructural development in the state could not improve the position of women. "Society remained feudal and women's development appalling resulting in low gender development index" (Government of Punjab, 2008). Economic prosperity is not always a sign of social progress for which the state has to answer for. The state with per capita income of ₹45,750 has just 893 females per 1000 males as compared to state of Bihar having per capita income of ₹12,012 with 923 females per 1000 males (Government of Punjab, 2012a). Gender inequalities in the form of low sex ratio, low female work participation rate, earning gaps between men and women, low level of representation in politics, low level of participation in community and political decision making presents a serious challenge for policymakers. Effective ways to reduce these gaps need to be looked into so that women become equal recipients of the fruits of economic progress. The objectives of the study are

a) to assess the status of women in Punjab
b) to know various reasons for low status of women in Punjab

METHODOLOGY

Secondary data were used for the study purpose. Secondary data were collected from various issues of Statistical Abstract of Punjab and India, Economic Surveys issued by Economic advisor to the Punjab Government, related literature and government reports, records and researchers which were hitherto conducted on gender issues.

Sex Ratios

The low sex ratios (the number of females per thousand males) in Punjab keeping with the National trends have established the fact that gender disparity starts at birth. This decline has been primarily because of patriarchal society and the easily accessible technology. "History points out that Punjab because of its prosperity and strategic location in North-West India attracted

outside invaders and served as Gateway of India. The people of this state suffered many wars and invasions which indirectly influenced its culture also. A fall out of war-related disgrace through females and also demand for male workers in agrarian society prompted female infanticide and male preference. Subsequently, other social vices like exorbitant dowry, gender-based violence etc all contributed to dwindling of female population of the state (Government of Punjab, 2008).

Table 1 shows that sex ratio in Punjab improved from 876 in 2001 to 893 in 2011. But it is much less than the national average of 943. The state ranked 26th in 2011 which was below its rank of 24 in 2001. Kerala not only maintained the first rank but also improved the ratio from 1058 in 2001 to 1084 in 2011. Chandigarh, the capital of Punjab and Haryana observed improvement in the sex ratio in 2011 but the rank plummeted to 32 in 2011 from 30 in 2001.What is more disturbing is the sex ratio of children below six years of age (Table 2). Sex ratio in 0-6 age group in the state improved from 798 in 2001 to 846 in 2011 but it was less than the National average of 914. It is indicative of the fact that from sex ratio of 893 to sex ratio of 846 (0-6 years), glaring gap of 47 points shows that 47 girls per thousand are missing in Punjab in 0-6 years age group. This indicates son preference in the whole region. Adverse sex ratios register high incidence of violence against women and unfavorable gender indices such as rape, sexual abuse, wife beating, and dowry.

Table 1. Sex ratio in Punjab: Other states and UT's (Females per 1000 males)

States/UTs	2001	Rank (All India)	2011	Rank (All India)
India	933	15	943	17
Punjab	876	24	893	26
Kerala	1058	1	1084	1
Chandigarh	777	30	818	32
Haryana	861	26	879	30
Daman and Duo	710	31	618	34

Source: Director, Census Operations, Punjab.

Table 2. Sex ratio in 0–6 age group (Punjab: India)

Total	2001	2011
India	927	914
Punjab	798	846

Source: Director, Census Operations, Punjab.

Table 3 shows percentage of women preferring sons to daughters in various National Family Health Surveys (NFHS) conducted from time to time. Results indicate that over the time from1992-2007, there has been marginal improvement in daughter preference. It has become a truth in the state that it is essential to beget at least one son, may be at any cost. 77.7 percent women wanted at least one son in 2006-07 as compared to 92 percent in1992-93. In 1992-93, the required technology helped the couples achieve their targets but not in 2006-07 when government had put up effective checks to control it. 1.3 percent of women wanted more daughters than sons as compared to 20.7 percent of women preferring more sons to daughters.

Female Work Participation Rate (FWPR)

Female work participation can contribute to economic development and can be important source of economic security for a woman. It can be a powerful weapon of increased empowerment of women. Technological and economic development in the state was expected to contribute favorably to increasing

Table 3. Sex preference of ever-married women in Punjab

(Percent)

Components	NFHS (2006-07)	NFHS (1998-99)	NFHS (1992-93)
Couples who want more sons than daughters	20.7	29.1	48
More daughters than sons	1.3	0.4	0.5
Who wants at least one son	77.7	86.2	92.0
Who want at least one daughter	68.9	78	85.0

Source: Statistical Abstract of Punjab, 2012.

Table 4. Sex-wise work participation rate

(Percent)

States/ UT	2001			2011		
	Male	Female	Total	Male	Female	Total
India	51.7	25.6	39.1	53.3	25.5	39.8
Punjab	53.6	19.1	37.5	55.2	13.9	35.7
Himachal Pradesh (max)	54.6	43.7	49.2	58.7	44.8	51.9
Delhi (min)	52.1	9.4	32.8	53	10.6	33.3

Source: Census of India, 2011.

FWPR. But the trend indicates that the state's economy has failed to integrate females into labour market which is quite disturbing.

Perusal of Table 4 indicates that as per census 2011, female work participation rate (FWPR) in the state was 13.90 percent as compared to male workforce participation rate of 55.2 percent. The corresponding figures were 25.5 percent and 53.3 percent at National level. FWPR of 2001 at the national level has remained the same in 2011 but for Punjab, there has been a rapid decline by 5.2 percent in 2011 from the previous census. Himachal Pradesh has been observed to have maximum FWPR of 44.8 percent whereas minimum has been observed for the state of Delhi where the rate was 10.6 percent in 2011. Low female work participation denies women from becoming economically empowered in Punjab. Women who were important contributors to farm activities have now become part of the household domain following the success of the green revolution. As a result, women in Punjab participate four times less in workforce than their male counterparts and twice less than women at national level. The cause of low FWPR in the state is mainly due to invisibility of her work, domestic chores and other tasks viewed as part of her cultural traditions, attitudes where man is considered as primary breadwinner (Nagaich & Sharma, 2014).

Table 5 projects the percentage of women employed under MNREGS. Figures show encouraging trend since its inception. In 2006-07, 40.6 percent of women were employed under MNREGA in India and in 2011-12, figure increased to 49.29 percent. The states also project healthy trend with Tamil Nadu leading with 74.70 percent of the women engaged in 2011-12 compared to 43.24 percent of women in Punjab engaged in gainful employment.

Table 5. Participation of Women (in employment) under MNREGS

(Percent)

States	2006-07	2009-10	2011-12
All India	40.6	48.65	49.26
Andhra Pradesh	54.79	58.10	57.13
Haryana	30.6	34.8	36.04
Punjab	37.76	26.29	43.24
Tamil Nadu	81.11	82.91	74.70

Source: www.nrega.nic.in.as on 23.4.12.

Table 6. Occupational composition of women employment

Components of employment	Percentage of women employed to total employment
In Public sector	20.55
In Private sector	18.86
In Government sector	25.38
Other workers	35.21

Source: Census of Punjab Government Employees. Economic and Statistical Organization, Punjab, 2011.
Other workers-Cultivators, Agriculture labourers,and Household industry workers.

Table 7. Major health indicators

Indicators	Punjab	India
Life expectancy at birth (Years)	69.3	66.1
Life expectancy (Male)	67.4	64.6
Life expectancy (Female)	71.6	67.6
Birth rate (Per 1000 live births)	16.2	21.8
Birth rate (Rural)	16.8	23.7
Birth rate (Urban)	15.2	18.01
Death rate (Deaths per thousand population per year)	6.8	7.1
Death rate (Rural)	7.5	7.8
Death rate (Urban)	5.6	6.3
Infant Mortality rate (Female) (PER 1000 live births)	33	46
Infant Mortality rate (Male)	28	43
Maternal mortality (Per 100,000 live births)	145	212
Total fertility rate (Average)	1.9	2.6

Source: Census of India, 2011.

Table 6 reveals percentage of women employed in various employment sectors in the state. Women constitute 25.38 percent of their total employment in government/semi government sector, 20.55 percent in public sector and 18.86 percent in private sector and 35.21 percent as workers (cultivators, agricultural labourers, and household industry workers).

Health Status

Major health indicators of Punjab in comparison to India show better human development indicators. Better facilities in health services have resulted in increase in life expectancy, fall in birth, death and infant mortality rates. However, there are inter-district, urban-rural, gender and other differences that need to be addressed to reduce gaps and work towards achieving gender equity in health.

Life Expectancy

Figures for various health indicators in Punjab (Table 7) indicate that the state has been successful in increasing the life expectancy at birth in 2011 as compared to earlier estimates for 2001. While comparing the life expectancy of Punjab with all India, it is observed that both males and female of Punjab have better life expectancy at 67.4 and 71.6 respectively as compared to 64.6 and 67.8 for national average respectively. Women in the state experienced increase in life expectancy more than the males in line with the national trends.

Birth Rate

Birth rate for the state was 16.2 live births per 1000 in a year which is lower than 21.8 in case of India in 2011. In 2001, corresponding figure for Punjab was 17.89 live births per 1000 in a year as compared to 23.5 for the national average. Birth rate for Punjab's rural population

has decreased from 18.4 in 2001 to 16.8 in 2011. For urban population, improvement in the corresponding figure was from 16.8 in 2001 to 15.2 in 2011, lower than the national corresponding figure.

Infant Mortality Rate

It measures number of infants (less than 1 year) death per 1000 live birth. Infants have higher probability of death in the country. The reduction in infant mortality is a national priority. The situation of Punjab compares favourably with the national scene. Census of India, 2011 shows female infant mortality to be more than male infant mortality. The figures are 33 and 28 which are less than the national average of 46 and 43 for female and male infant mortality respectively.

Despite great progress achieved in various fields like high standard of living, access to basic amenities, higher female literacy, higher health care facilities, female mortality is a cause of concern and the problem needs to be addressed in Punjab. Maximum infant mortality rate is in Madhya Pradesh (67) and minimum is in Kerala (12). Female infants experience higher mortality than male infants.

Total Fertility Rate

Total Fertility Rate (TFR) measures average number of children born to a woman during her entire reproductive period. TFR for India was 2.6 during 2008-09. Kerala and Tamil Nadu points to the lowest TFR (7), Bihar reported the highest (3.9) and Punjab (1.9). Rural women have TFR of 2.9 at national level indicating that they would have about 1 child more than an urban woman (2.0) on an average. Punjab is the second state to have reduced TFR. "The decrease in fertility rate in Punjab despite strong son fixation mindset, presence of socially backward population is manifestation of development factors such as family planning programme, female literacy, and prosperity at household level" (Government of Punjab, 2008).

Maternal Mortality Rate

Maternal Mortality Rate (MMR) measures number of women aged 15-49 years dying due to maternal causes per 100,000 live births. In India, MMR decreased from 254 in 2004-06 to 212 in 2007-09. The corresponding figures for Punjab were 145, Kerala (81), Tamil Nadu (97) and Assam (390)

Table 9. Representation of Women in Lok Sabha and State Legislative Assembly of Punjab

(Percent)

Year	Women in Lok Sabha	Women in Vidhan Sabha
1957	5.88	7.43
1967	15.38	1.92
1980	15.38	5.12
1985	7.69	3.43
1992	15.38	5.12
1998	7.69	N/A
2002	N/A	6.86
2007	N/A	6.84%
2009	30.76	N/A
2012	N/A	11.97%
2014	7.6	N/A

Source: Till 2002: Human Development Report, 2004, Punjab (2004), Government of Punjab, 2002-2014 Newspapers Reports.

Table 10. Empowerment of women

Components of empowerment	Percentage of women
Women Judges in Punjab and Haryana High Court	9.76
Women sarpanches in Punjab	29.86
Women panchayat members	28.07
Women candidates contesting 2012 Assembly elections	8.63
Women participation in 2012 polls	60.21
Women electorates	47.41

Source: Government of Punjab (2012a).

Table 11. Human and gender development indices

States/U.T.	HDI	Rank	GDI	Rank
Punjab, 1996	0.621	10	0.605	11
Punjab, 2006	0.668	14	0.663	14
Kerala	0.764	2	0.745	3
Chandigarh	0.784	1	0.763	1
Bihar	0.507	35	0.479	35
All India	0.605		0.590	

Source: Compiled from Statistical Abstract of Punjab, 2012.

Table 8. Literacy rate

(Percent)

India/ States	2001				2011			
	Females	Males	Total	Gap	Female	Male	Total	Gap
India	53.7	75.3	64.8	21.6	64.6	80.9	73.0	16.3
Punjab	63.4	75.2	69.7	11.9	70.7	80.4	75.8	9.7
Kerala	87.9	94.2	90.9	6.3	92.1	96.1	94.0	4.0
Jharkhand	38.9	67.3	53.6	28.4	55.4	76.8	66.4	21.4

Source: Census of India, 2011.

Literacy Status

Table 8 reveals that as per 2011 population census, the state achieved literacy rate of 75.8 percent which was slightly higher than the national average of 73 percent. The rate is above the literacy rate of 69.7 percent it achieved in 2001. Kerala recorded the highest literacy rate (94 percent) and Jharkhand the lowest (66.4 percent) in the country. Reading through figures of 2011 census, only 70.7 percent of females in Punjab were literates as compared to 80.4 percent of males. Kerala achieved highest female literacy rate of 92.1 percent which was 21.4 percent higher over female literacy in Punjab. Gap in literacy rate among males and females in Punjab decreased over the years from 11.9 percent in 2001 to 9.7 percent in 2011. Gender gap in literacy is observed to be maximum for Jharkhand (21.4 percent) and minimum for Kerala (4 percent).

Empowerment of Women

Participation of women in social and political fields serves as a tool for empowerment of women. Political participation of women in India and Punjab has been very poor. This participation can help her get integrated into the mainstream. The number of women in political decision making in the state has remained minimal in parliament and state legislature. The gender development index is based on number of seats held by women in parliament. Government has henceforth reserved 33 percent seats for women at all levels starting from panchayat to parliament. Due to rigidity of culture and patriarchal society, women from time immemorial have remained and have been kept away from this field. As a result, fewer women opt to participate in politics. Low participation by women results in inequalities and discrimination against women.

Table 9 reveals women representation from Punjab in Lok Sabha and Vidhan Sabha. As far as representation of women in Lok Sabha (2014) is concerned, 7.6 percent women represent Punjab whereas in 2009, best ever 30.76 percent women were the representatives. In the State Legislative Assembly (2012), 11.97 percent women were elected representatives. Women do contest panchayat election but the decision making at village level is by her husband.

Observation of the Table 10 indicates less representation of women in political and judicial sphere. Out of total of 41 judges, only 4 (9.76 percent) are females. Women sarpanches accounted for 29.86 percent of the total number of sarpanches and 28.07 percent of panchayat members during 2011-12 panchayat elections. This was mainly due to reservation of seats by the government for women candidates in panchayat elections. Only 8.63 percent of women candidates contested in 2012 Vidhan Sabha elections from various political parties. Percentage of female voters polled to total women electorate was 60.21 percent and corresponding male percentage was 70.06 percent.

Human Development Index (HDI) and Gender Development Index (GDI)

HDI and GDI are the indices used to estimate the state of population. HDI reflects the scale of human development for the society as a whole. "It's ranking compares population on 3 parameters (health, education, and income). GDI compares the state of development of women with men" (Government of Punjab, 2008). It assumes that men and women should share equally the fruits of progress.

According to Human Development Report, Punjab ranked 14th in HDI and GDI among 32 states/UTs but its GDI value (0.663) is less than HDI (0.668) thus pointing towards low socio-economic status of women. Chandigarh ranked first at the national level in HDI and GDI despite the fact that Chandigarh ranked 32(third last) in declining sex ratio. This is due to the fact that sex ratios and FWP are not taken into account while computing GDI. Among the Indian states, Bihar ranked 35th (last) in HDI and GDI.

Observation of gender indicators in case of Punjab shows lower level of child mortality rates, higher life expectancy, relatively late marriages, less levels of total fertility rates, higher female literacy as compared to the National average and for some other states. These indicators point to better female status but strong sex preference and low sex ratios are more evident. This is in conformity with the views presented by Dyson & Moore (1983) who expressed that "demography of Sikh dominated Punjab stands out in some way from other states of north". Sikhs pattern of marriage and family organization is the same as of other northern states but due to egalitarian religion, their Guru's and religious heads have tried to transform certain disabilities women used to suffer under the old code.

Reasons for Low Status of Women

Low status of women in Punjab can be traced to the cultural history of the region which does not allow freedom of mobility to females and also discourages their participation in outdoor activities. There is complex linkage of caste, class,and patriarchy in the rural areas which results in low work participation rate of women. Due to dominance of upper caste, there are limits to outside employment as these women do not work in any other area except farming. The invisibility of their work marginalizes these women (Kak, 2012).

The behaviour of rural women is controlled oppressively by social formations that regulate their lives. These formations are called panchbutas-five elements of class, caste, community/religion, family and kinship and the dominant social norms dictated by them. They dictate the dos and don'ts for women, the work that they might or must not do, the freedom that they may or may not enjoy. This network manifests in the form of wage disparities and discrimination in participation in economic, socio-legal or political matters (Gill, 1996).

The state has patriarchal setup and follow patrilineal mode of family. Daughter has freedom at her father's

place and uses it when she visits back but inheritance rights are not for her. Gupta (1987) stated out that "there was no question of a woman owning land in Jat kinship system in Punjab. If she insists on her right to inherit land, she would stand good chance of being murdered". In social system of Punjab, women are rarely given a share in father's property. The reasons advanced are that it would lead to subdivision and fragmentation of family land. "It will reduce output by reducing farm size and increasing fragmentation". It was also feared that inheritance to girls would lead to sale of ancestral land because of exogamous nature of marriage.

Aggarwal (1996) argues that "fragmentation can arise equally with male inheritance. She elaborated that there is no reason to fear an adverse side effects. The negative relationship between size and productivity still holds after green revolution. Another popular agreement against giving daughters inheritance share has been that they get dowries instead which represent them fair share in parental property".

Sisters and daughters voluntarily forgo their claims of inheritance in the state. The bias of the patwaris comes to the fore while recording daughter's inheritance share in North India. "Where women do not voluntarily forgo their claim, male relations have been known to file court cases; forge wills and resort to threats"(Ibid).

CONCLUSIONS

Development of a nation in true sense cannot be achieved without development and empowerment of women population. Our culture from time immemorial has been relegating women to a lower position in terms of socio-economic status. As such, culture and traditions which encourage subordination of females are the major constraints to female empowerment and equality in her status with men. Women face discrimination with respect to birth, rearing, health care, education, social practices, access to ownership and control of resources.

All round prosperity was ushered in the state of Punjab in mid-sixties as a result of technological changes in the form of green revolution in the agricultural sector in particular. The question that needs to be looked into is whether changes in technological and economic development in the state have positive effect on women's status, welfare,and empowerment. Statistics indicate that high gender disparities still persist in the state. The low sex ratios at birth (893 females to 1000 males) and in 0-6 age group (847 females to 1000 males) in the state are much less than the National average of 943 and 914 respectively as per 2011 census. There has been decline in Female Work Participation Rate (FWPR) in Punjab by 5.2 percent in 2011 from previous census of 2001. FWPR in Punjab was 13.9 percent in2011 as compared to 25.5 percent at the national level and 55.2 percent for male work participation in the state. The success of green revolution has pushed women who were important contributors back into household domain. The state achieved female literacy rate of 70.7 percent which was lower than male literacy of 80.4 percent in 2011.Punjab ranked 14th in Human and Gender development indicators (HDI and GDI) among 32 states/UTs but value of GDI was less than HDI indicating low status of women.

REFERENCES

Aggarwal, B. (1996). *A field of one's own: gender and land rights in South Asia*. Cambridge South Asian Studies, Cambridge: Cambridge University Press.

Dyson, T., & Moore, M. (1983). On kinship structure, female autonomy, and demographic behavior in India. *Population and Development Review, 9*(1), 35-60

Gill, M.S. (1996). Women and equality in Upadhaya (Ed.). *Women in 21st century.* New Delhi: Harnam Publications.

Government of Punjab (2008). *A study of gender empowerment and declining sex ratio in Punjab*. Economic and Statistical Organisation, Department of Planning. Document F2007043. Final Report. Retrieved from www. pbplanning.gov.in.

Government of Punjab (2012). *Statistical abstract of Punjab*. Chandigarh: Economic and Statistical Organization, Government of Punjab.

Government of Punjab. (2012a). *Gender statistics of Punjab*. Economic and Statistical Organization, Punjab. Retrieved from www.pbplanning.gov.in

Gupta, M.D. (1987). Selective discrimination against female children in rural Punjab, India. *Population and Development Review*, *13,* 77-100.

Kak, S. (2012). Impact of the agrarian crisis on woman in Punjab. In Ranjana Padhi (Ed.). *Those who did not die*. New Delhi: Sage Publication.

Nagaich, S., & Sharma, P. (2014). Trends in women work participation in Punjab (India). *Asian Journal of Research in Social Sciences and Humanities, 4*(5), 233-246.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 463-467
DOI: 10.5958/2322-0430.2018.00097.5

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Economic Sustainability through Women Self Help Groups in Tribal area of Gujarat

*Nilam Rathod and Ganga Devi**

Department of Agriculture Economics, B.A. College of Agriculture
Anand Agricultural University, Anand-388 110 (Gujarat), India

**Corresponding author's email: gangasaran1982@gmail.com*

Received: December 21, 2017 *Manuscript Number: NS-18-27* *Revision Accepted: February 15, 2018*

ABSTRACT

Microfinance is prove one of the better option to empowering the rural or tribal women by income and employment generation through Self Help Group formation. This, in turn, can have positive social effects at different levels of society, from personal, to community, and even at the regional level. The study is based on primary data collected from 120 respondents (60 SHG-members and 60 SHG non-members) from 10 villages of Garbada and Dahod talukas from Dahod district of Gujarat. The results revealed that the SHG members had maximum income from agriculture (32.25 percent), followed by livestock (31.49 percent)andincome through SHG activities (12.88 percent). SHG members earned additional income `8375.72 (12.88 percent of total income) by participating in SHGs. In case of employment, the average agriculture sector provided 88.31 man-days per annum higher employment in case of SHG members as against 75.83 man-days per annum in SHG non-members.The study clearly showed significant positive impact on income and employment generation through Self-Help Groups.SHG members had better repayment capacity than non-members due to better income of members. The various ratios calculated for SHGs showed sound financial status of SHGs as well as their members indicating that SHGs cater efficiently to their financial needs.

Keywords
Employment, financial performance, income, repayment capacity, self-help groups.

JEL Codes
C51, C81, B26, G23, P44, Q01.

INTRODUCTION

According to National Bank for Agriculture and Rural Development (NABARD) "Micro-finance is provision of thrift credit and other financial services, products of very small amounts to the poor in rural, semi-urban or urban areas, for enabling them to raise their income levels and improving living standards". The financial services may include saving credit, insurance, leasing money transfer, equity transfer, *etc.,* that is any type of financial services provided to customers to meet their financial needs. It generally performs various types of economic activities with the help of their small savings. It is a service provider for poor people who are unemployed, who are poor entrepreneur's component of financial sector for the development and alleviation of poverty. It is treated as an important approach to poverty alleviation programme and enhancement of living standard, particularly of women in developing countries, like India. Empowerment of rural women is a necessary condition for nation's economic development and social upliftment. The formation of SHGs is not only a micro-credit project but also an empowerment process. Generally, the economic benefit includes mobilization of savings and credit facilities and to pursue group based economic activities. SHG approach is the group based approach, which helps the poor women members of each SHG to accumulate capital by way of small saving and helping them to get credit facilities from their funds. Presently, the poor women of the society are facing the financial problem to start business or to undertake different economic activities to become self-employed and self-reliant. Micro-finance through the self-help groups develops the entrepreneurial skills among rural women community and helps them to be self-employed.

The growth of SHGs linked with the banks in India increased from 10.69 to 79.03 lakh during 2004-05 to 2015-16, respectively (NABARD, 2016).

Micro-finance in Gujarat can trace its origins back to the early 1970s when the Self Employed Women's Association (SEWA) formed an urban cooperative bank, called ShriMahila SEWA Sahakari Bank with the objective of providing banking services to poor women employed in the unorganized sector in Ahmedabad City, Gujarat (Patel *et al.,* 2014). As a result of continuous efforts, 2.96 lakh SHGs were linked with banks and saving of SHGs was ₹ 213.28 crore in the year 2015 and also average loan issued per SHG increased from ₹ 50000 to ₹ 80000 in the Gujarat state (NABARD, 2016).

DATA AND METHODOLOGY

The present study was undertaken in Dahod district of Gujarat which covers total seven talukas. A multi-stage sampling design was adopted for the study**.** From the seven talukas, two talukas (Dahod and Garbada) were selected purposively on the basis of higher number of SHGs and from each taluka, five villages were selected purposively where at least five-year-old two women SHGs were functioning. From each village, two SHGs were randomly selected. Therefore, total 10 villages and 20 SHGs were selected from Dahod district. Two types of respondents were selected (SHGs members and non-members) for comparative analysis. Finally, 3 members were selected randomly from each selected SHGs. Again, similar types of 3 non-members who have same socio-economic status were also selected from the same villages to compare the socio-economic profile, income and employment level of SHG members' vis-à-vis non-members. Thus, total 120 respondents (60 members and 60 non-members) were selected. Both the primary and secondary data were collected from the study area. The primary data were collected by personal interview/ inquiry method. The detailed information required for the study was collected from each of the selected households for the year 2015-16.

The data collected from SHGs and their members were systematically arranged, organized and finally subjected to tabular analysis for drawing inference in order to assess the economic parameters such as financial performance, income, and employment of SHG members' *vis-à-vis* non-SHG members. In tabular analysis, simple comparisons were made on the basis of percentage.

Estimation of financial performance of SHGs

The average recovery ratio, thrift credit ratio, and outstanding credit ratios were calculated for assessing the financial performance of SHGs by using the following methods (Srinivasan *et al.,* 2001).

$$\text{Average Recovery Ratio} = \frac{\text{Actual amount recovered during the time period}}{\text{Total demand raised during the period}} \quad 100$$

$$\text{Thrift Credit Ratio} = \frac{\text{Total saving}}{\text{Total lending}}$$

$$\text{Outstanding Credit Ratio} = \frac{\text{Total outstanding amount}}{\text{Total lending amount}}$$

Estimation of repayment capacity

The financial performance of SHG members was adjudged on the basis of their repayment behaviour. Repayment capacity refers to the amount available with him after meeting his farm and family needs and obligations to repay the loan under consideration. The following formula was used to work out the repayment capacity (Reddy & Ram, 1996).

Repayment Capacity (RC) = Gross income – (Working expenses excluding proposed loan + family living expenses + other loan dues + miscellaneous expenditure + loan taken).

A number of factors influence the repaying capacity of the selected households. With a view to identify the factors responsible for repaying capacity, the repayment capacity function was fitted for the SHG members.

The model: The functional form used in the study was as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, u)$$

Where,

Y= Repayment capacity per households per year (₹).

X_1= Gross income per households per year (₹).

X_2=Working expenses per households per year (₹).

X_3= Family living expenses per households per year (₹).

X_4= Miscellaneous expenses per households per year (₹).

X_5= Educational score of the SHG members.

U= Random term with usual properties.

In the present study, both the linear and Cobb-Douglas models were tried and Cobb-Douglas model was finally selected on the basis of economic and statistical criteria.

RESULTS AND DISCUSSION

Income of any household determines the standard of living and ensures the growth of assets to sustain the realized prosperity in the long run. As income increases, household welfare improves through increase in consumption expenditure which leads to the food and nutritional security of the people.

Sources of household's income for SHG members and non-members

The perusal of Table 1 shows thatthe SHG members had maximum income from agriculture (32.25 percent), followed by livestock (31.49 percent), non-agricultural labour (17.11 percent) and additional income through SHG (12.88 percent). SHG members earned additional income ₹8375.72 (12.88 percent of total income) by participating in SHGs activity. The average income was observed to be higher from agriculture and livestock (₹20962.60 and ₹20469.03) as compared to non-member households (₹18480.50 and ₹14806.83), respectively.

The overall average income from agriculture and livestock for the member households was significantly higher than the non-member households. This can be attributed to better financial resources and agricultural raw materials available with member households for purchase of high-quality inputs. Similarly, the gross income of SHG members was higher due to the other economic activities undertaken by the SHG members included tailoring unit, kirana shop, flower vending and production of homemade food items *etc.,* relatively higher income observed across SHG member as compared to non-member was in conformity with the findings of Reji (2009); Bellundagi *et al*. (2014). It can be concluded that because of the SHG, the members earned significantly more income (₹8375.72) than non-members implying a positive impact of SHGs on the income of member households which extended various facilities to the members.

The magnitude of employment generation by different activities reflects its economic soundness and viability. Besides, employment is the final indicator through which impact of any development programme can be assessed. Table 2 puts forth that, on an average agriculture sector provided 88.31 man-days per annum higher employment in the case of SHG members as against 75.83 man-days per annum in non-members. This may due to the fact that SHGs were more helpful to the members in meeting their financial needs. An adequate amount of micro-loans through SHGs has been instrumental in generating significant employment in tribal areas. The employment from livestock was observed to be more in members (44.50 man-days per annum) as compared to non-members (29.15 man-days per annum). The results show that the SHGs members have increased proportion of employment more than three months.

The financial performance of SHGs and its members was measured by using different ratios such as thrift-credit ratio, outstanding ratio and recovery ratio. SHGs collect savings amount weekly/monthly from the members whereby, weekly savings are encouraged as it is easier for a member to save during the week and pay the amount. Savings to be collected are fixed in each group for each member. The amount to be collected as savings varies from group to group. Further, the financial performance of SHG members was judged on the basis of

Table 1. Source-wise income of the sample households

(₹/Year)

Sources of income	Members (n_1=60)	Non-members (n_2=60)	Difference	t-test
Agriculture	20962.60 (32.25)	18480.50 (35.41)	2482.10	2.309**
Agriculture labour	4077.50 (06.27)	4890.00 (09.37)	-812.50	-0.685
Non- agriculture labour	11125.00 (17.11)	14007.60 (26.84)	-2882.60	-1.016
Livestock	20469.03 (31.49)	14806.83 (28.37)	5662.20	2.953**
Income through SHG	8375.72 (12.88)	-	8375.72	
Total	**65009.85** **(100.00)**	**52184.93** **(100.00)**	**12824.92**	**3.207*** **

****** and ** Significant at 1 and 5 percent level.***
Figures within the parentheses indicate percentage to total.

Table 2. Employment generation for SHG member and non- member households

(Man days/year)

Particulars	Employment		Difference	t-test
	Members (n_1=60)	Non-members (n_2=60)		
Agriculture	88.31	75.83	12.48	3.53***
Agriculture labour	26.75	34.31	-7.56	-0.93
Non-agriculture labour	44.50	49.36	-4.86	0.97
livestock	44.50	29.15	15.35	3.73***
SHGs	83.50	0.00	83.50	
Total	**287.56**	**188.65**	**98.91**	1.97**

****** and ** Significant at 1 and 5 percent level.***
Figures within the parentheses indicate percentage to total.

repayment capacity of the SHG members and non-members. The average total savings and average total lending per SHG was found to be ₹17368.12 and ₹31957.80, respectively. The average outstanding amount was found to be ₹1995.28. The thrift credit ratio was also found to be higher (0.54) which could be due to higher amount saved by the members. Further, the outstanding ratio was found to be lower (0.06) which could be due to the timely repayment of loan amount by Self Help Groups. The recovery ratio provided in the table shows that the recovery was around 74.29 percent. This may be due to the groups being more serious in timely recovery of loan resulting in lower outstanding ratio. This, in turn, implied that the overall financial performance of SHGs was better (Table 3). Similar findings were reported by Madheswaran & Dharmadikary (2001); Devi & Jain (2011); Ranjan &Tyagi (2015) as they reported about 80 to 98 percent of recovery from SHGs.

The financial performance of selected respondents was judged on the basis of repayment capacity of the members. The results presented in Table 4 show that the repayment capacity of the SHG members was higher at₹3416.58 as compared to the ₹800.27 of non-members. This can be attributed to relatively higher annual gross income of SHG members as compared to the non-members (₹52184.94).

Table 3. Financial performance of the sample SHGs (n=20)

Particulars	Amount (₹)
Average savings (₹)	17368.1
Average lending (₹)	31957.8
Average outstanding amount (₹)	1995.28
Amount recovered (₹)	25899.8
Demand raised (Principal amount + Interest) (₹)	34860.2
Thrift credit ratio (1÷2)	0.54
Outstanding ratio (3÷2)	0.06
Average recovery ratio (4÷5 x 100)	74.29

Table 4. Repayment capacity of the SHG members and non- members (₹/Household/Year)

Particulars	Members	Non-members
Gross income from all sources	65009.85	52184.94
Working expenses	17340.80	18516.33
Family expenses	24304.40	20090.00
Miscellaneous expenses	6731.40	5220.00
Total expenses	48376.60	43826.33
Loan taken	13216.67	7558.33
Repayment capacity	3416.58	800.27

Table 5 presents the results of repayment capacity function for SHG members. The coefficient of multiple determinations (R^2) for the members was 0.93 which indicated that 93 percent of total variation in repayment capacity was explained by the variables included in the selected regression model. It was observed that regression coefficient of gross income was found to be positive and statistically significant.

On an average, one percent increase in the gross income resulted in an increase of 0.856 percent in repayment capacity of members. The regression coefficient of working expenses was found to be negative and significant ($P<0.01$). On an average, one percent increase in the working expenses resulted in a decrease of 0.70 percent in repayment capacity of members. This suggested that repayment capacity of the members decreased with increased in working expenses. Regression coefficients of family living expenses and miscellaneous expenses were found to be negative but statistically non-significant. This indicated that there was no significant impact of family living and miscellaneous expenses on repayment capacity of members. Similarly, the regression coefficient of education score was found to be positive and statistically significant.

Table 5. Estimated parameters of repayment capacity function for the SHG members

Variables	Regression coefficients	Standard error
Constant	-41784.4**	5454.53
Gross income (X_1)	0.8567**	0.098
Working expenses (X_2)	-0.6942**	0.203
Family expenses (X_3)	-0.1784	0.124
Miscellaneous expenses (X_4)	-0.3635	0.473
Education score (X_5)	3645.10**	1176.90
R^2	0.93	
n_1	60	

***Significant at 5 percent level.*

CONCLUSIONS

SHGs have been instrumental in upliftment of its members by ensuring gainful employment opportunities and catering to their member needs. Micro-finance through the self-help groups has developed the entrepreneurial skills among tribal rural women community and helped them to be self-employed. SHGs are responsible for significant positive change in the economic variables like self-income, employment generation, asset building, productive investment, repayment capacity, and savings. Thus seeing the positive impact, steps should be taken to bring greater SHG network in rural areas by making the people aware about the benefits of the finance made available through SHGs. The role and contribution of NGOs in the formation and functioning of SHGs is noteworthy. Therefore, these NGOs should concentrate in providing training and

awareness programme for the benefit of members of SHG. SHG if efficiently organized can be an effective instrument to create income and employment opportunities in rural areas.

REFERENCES

Bellundagi, V., Patil, S.S., & Jadhav, V. (2014). Impact of micro-finance on member of self-help group-shree shakti group, *Agricultural Economics Research Review, 27,* 193.

Devi, G., & Jain, D.K. (2011). Financial performance of dairy self-help groups in Jaipur district of Rajasthan: A comparative analysis. *Indian Journal of Dairy Science*, *64*(5), 435-439.

Madheswaran, S., & Dharmadhikary, A. (2001). Empowering rural women through self-help group in Pune district of Maharashtra. *Indian Journal of Agricultural Economics*, *56*(3), 427-442.

NABARD. (2016). *Annual report of status of micro-finance in India*. National Bank for Agricultural and Rural Development. Retrieved from https://www.anonymous.org/auth/writereaddata/tender/2308170405Anonymous%20Annual%20Report%202016-2017-ENGLISH.pdf

Patel, K.J, Patel, K.M., & Modi, A.G. (2014). Impact of microfinance services on rural women empowerment: An empirical study. *Journal of Business and Management*, *16*(11), 68-75.

Ranjan, S., & Tyagi, D. (2015). Micro-credit through self-help groups for rural poor in Uttar Pradesh: An investigation into the SHGs financial performance. *Indian Journal of Economics and Business*, *14*(3), 413-421.

Reddy, S.S., & Ram, P. R. (1996). *Agricultural finance and management* (Pp. 88-91). New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

Reji, E.M. (2009). Socio-economic impact of microfinance: A study of neighborhood groups (NHGs) in Nilambur block of Malappuram district, Kerala. *Indian Journal of Agricultural Economics, 64*(2), 246-258.

Srinivasan, G., Varadharaj, S., & Chandrakumar, M. (2001). Financial performance of rural and urban self-help groups in Coimbatore district of Tamil Nadu. *Indian Journal of Agricultural Economics, 56*(3), 478-479.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 468-472
DOI: 10.5958/2322-0430.2018.00098.7

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Factors Affecting Awareness of Farmers about Genetically Modified Crops in Punjab

Pranoy Ray[1] and V.K. Rampal[2]*

[1]*Ph.D Research Scholar in Department of Extension Education, Orissa University of Agriculture and Technology Bhubaneswar-751003 and* [2]*Deputy Director, Krishi Vigyan Kendra, Ropar-140001*

[*]*Corresponding author's email: pranoy-ee@pau.edu, rampalvk@pau.edu*

Received: December 23, 2017 *Manuscript Number: NS-18-30* *Revision Accepted: February 13, 2018*

ABSTRACT

This paper investigates the farmer's awareness about various aspects of the genetically modified crops and foods. Sixty farmers were selected from each of the two highly producing districts of Punjab in terms, of genetically modified crops. Thus a total of one hundred and twenty respondents were selected for the study. The data were collected with the help of self-structured interview schedule. Findings of the study revealed that majority of farmers; about 62.5 percent had high level of awareness towards every aspect of genetically modified crops. Correlation analysis revealed that mass media exposure, extension contacts, progressiveness and risk orientation contribute significantly and linearly to the awareness level of farmers. The multiple regression analysis determined the contribution of these factors more concretely with how much amount. Therefore, modern techniques in agriculture need to be well targeted in accordance to the socio-psychological and socio-personal factors of farmers. Gap in level of awareness about the GM technology needs to be resolved by providing genetic literacy among farmers.

Keywords

Awareness, correlation, GM crops, and foods, multiple regression analysis.

JEL Codes

C81, O14, Q16, Q18.

INTRODUCTION

Agriculture which has always been saviour of human civilization is facing enormous challenges in twenty-first century. In order to feed growing population more food and fibres need to be produced with stagnating labour force to contribute for the overall development in developing countries. The introduction of genetically modified (GM) crops has been anexemplary progress to world agriculture over the last couple of decades. It has been found that technology has the perspective to not just enhance global food yields but also can lead to sustainable development. Making utilization of present-day biotechnology, including GM, is one approach to diminish weight on farming resources, by enhancing food quality; expanding the efficiency of the crops and helping crops adjust to ecological burdens such as drought and disease pest incidence. Genetically modified organisms (GMOs) can be defined as organisms in which the genetic material (DNA) has been altered in a way that doesn't occur naturally by mating or natural recombination. The technology is regularly called as "modern biotechnology" or “gene technology”, sometimes also “recombinant DNA technology” or “genetic engineering”. It enables desired genes to be transferred from one creature on to the next, also between non-related species (Genetically Modified Food, 2015). Globally, since being introduced commercially in 1996, GM crops have contributed to food security, sustainability and the abatement of climate change. A record 185.1 million hectares of biotech or GM crops were grown globally by 2016, at an increase in growth rate of three percent from 2015 (ISAAA, 2016). With around 18 million farmers involved in its cultivation across the 28 countries of the world, biotech crops have set a precedent that the biotech area has grown impressively every single year for the past 20 years and achieved remarkable 100-fold increase since it's commercialization in 1996. Thus, biotech crops are considered as the fastest adopted crop technology in the

history of modern agriculture (WHO, 2014). In terms of genetically modified crops cultivation area, India has global ranking of 5th with 10.8 million hectares of genetically modified crops area behind USA (72.9Mha), Brazil (49.1Mha), Argentina (23.8Mha) and Canada (11.6Mha). It is interesting to find that, among the 18 biotech mega-countries, 14 are from developing countries of Asia, Africa, and Latin America. The State of Punjab which is the breadbasket of India, have around 75 percent (Agriculture Punjab, 2015) of population dependent on agriculture. Presently, Punjab agriculture is very progressive in terms of inputs and technologies used. GM crops (Bt cotton) were introduced in Punjab in 2002 as part of GM revolution in India. In the year 2016, around 2.43 lakh hectares of Bt cotton was grown in Punjab which is less than 2015 cotton area (3.05 lakh ha). The decrease in Bt. cotton area was mainly due to severe white fly infestation of 2015. The severe whitefly infestation raised concerns about growing dependency upon Bt. cotton in Punjab. The GMO Bt. cotton which was engineered to produce Bt. cotton, are now perceived to be vulnerable to attack by non-target insects and has increased the application of pesticides. The expanding development of GM crops has raised extensive worries regarding food security, ecological impacts, financial issues and health hazards. It has been found by researchers that genetic literacy amongst farmers has been generally low about various aspects of GM crops. Further a lack of awareness and knowledge about transgenic and genetically modified (GM) foods also retard development of favourable attitude among the public. Respondents show reservations and low level of awareness towards food crops more than cash crops where number of other factors like biosafety regulations, familiarity, moral aspects or type of gene transfers played a crucial role (Aerni & Bernauer, 2005; Gene Campaign & University of Hyderabad, 2009; Hall, 2008; Han *et al.,* 2015). The findings from some studies brought out cautious approach of stakeholders towards genetically modified crops (Amin *et al*., 2013; Elum & Sekar2015). The object for the present study has been referred to genetically modified crops and foods. The success or failure of any idea or technology to a larger extent depends upon the awareness level of stakeholders towards it. Considering this, effort has been put forward for assessing the awareness of farmers about genetically modified crops which can be utilized by other researchers beyond the study area.

MATERIAL AND METHODS

Awareness referred to the initial knowledge of GM crops. It was operationalized as the extent to which respondents were familiar with development of GM crops, package of practices, potential benefits, and ethical issues. The extent of awareness for each item was judged by assigning scores 1 and 0 for aware and non-aware respectively. The study was conducted in the Malwa region of Punjab purposively because genetically modified crop in the form of Bt. cotton was introduced in this region of Punjab. In Malwa region, two districts namely, Bathinda and Fazilka with highest acreage under transgenic crops were selected. Then from each of the selected districts, 3 blocks were selected randomly. A sample of 120 farmers drawn randomly, with 10 farmers from each of the 12 selected villages selected through simple random sampling technique. The data were collected through self-structured interview schedule. The statistical analysis of data was done through Spearman's Correlation method and multiple regression analysis.

RESULTS AND DISCUSSION

In examining awareness of farmers, various sub-aspects were focussed upon for determining awareness level of farmers.

Awareness of Farmers towards Development of Genetically Modified Crops

The glance of data in Table 1 indicated that almost three-fourths (74.16percent) of farmers had idea about the year of approval for commercial cultivation of GM crops followed by 60.00 percent of farmers were aware about transgenic hybrids developed by MAHYCO in collaboration with Monsanto and 59.16 percent of farmers were aware about development of new genetically modified crops. Less than half (45.83 percent) of farmers were aware about a gene used in Bt. cotton hybrid. Only 4.16 percent of farmers were aware about higher level of Vitamin A level will be higher in golden rice than other rice hybrids. Similar findings were also found by Sanjeev & Gandharappa (2006)

Awareness of Farmers Related to Package of Practices of GM Crops

It was very interesting to find that 85.62 percent of farmers were aware about the various packages of practices of GM crops in our study area. Large percent of farmers (95.83percent) were aware about growing non-Bt cotton as refugia to build-up resistance against Bt. cotton. Almost ninety-twopercent of farmers were aware about not to grow bhindi, arhar, dhanicha in and around Bt. cotton crop. A high majority (86.66 percent) of farmers were aware about not to cultivate Bt. cotton near orchard. About 67.50 percent of farmers were aware that Bt. cotton can be prevented from bollworm if 20.00 percent area is under refuge using recommended insecticide.

Awareness of Farmers about Mode of Action of Bt

The awareness of farmers regarding mode of action of Bt protein is quite high (66.66 percent). This may be due to high genetic literacy provided in study area after whitefly menace.

Awareness of Farmers regarding Biosafety and Regulation

Biosafety and regulation aspects had a greater awareness in the study area with about 76.11 percent of farmers being aware about it. Large numbers of farmers were aware about need to label the GM products viz. 88.33 percent followed by 75.00 percent of farmers being aware about various biosafety aspects rigorously tested

Table 1. Distribution of farmers according awareness about different aspects of GM crops

Statements	Frequency	Percentage
Development of GM crop		
Approval for commercial cultivation of Bt. cotton was granted in 2002 by Indian government.	89	74.16
The transgenic hybrids were developed by MAHYCO in collaboration with Monsanto.	72	60.00
There is a gene present in Bt Cotton hybrid known as Cry-1Ac.	55	45.83
Level of Vitamin A is higher in golden rice than other rice hybrid.	5	4.16
Brinjal, Tomato, Mustard, Chickpea are the other genetically modified crops being developed.	71	59.16
Package of Practices of Bt. Cotton		
Growing of non-Bt. Cotton as refuge to prevent the build-up of resistance against Bt. in bollworm	115	95.83
Bt. Cotton is protected against bollworm only if 20percent area is under refuge by using recommended insecticide.	81	67.5
Avoid sowing Bt. Cotton near orchard	104	86.66
Avoid growing Bhindi, Arhar, Dhanicha in and around cotton for alternate host of whitefly.	111	92.5
Mode of Action of Bt.		
The Bt. protein killed the bollworm through destruction of their intestinal gut.	80	66.66
Biosafety & Regulation		
Department of Biotechnology and Ministry of Environment and Forests, Government of India are the two regulating bodies for biosafety issues related to GM Organisms.	78	65
It is essential to label the GM crops/food to facilitate the consumers to distinguish them from non-GM crops/food.	106	88.33
Biosafety aspects (Biosafety of human and animal health), labeling of GM food, antibiotic resistance gene in GM food, environment concerns, gene transfer, etc.) are rigorously tested under field trial before release of GM crops.	90	75
Potential Benefits		
GM crops help the farmers to manage devastating insects, weeds and weather condition to produce more from less acreage and then feeding more population.	99	82.5
It will increase farm income by adopting herbicide-tolerant seed (like soybean and corn)	30	25
It will provide future healthier and more nutritious food like golden rice and soybean variety with healthier fatty acid profile.	18	15
It reduces the pesticide and herbicide application and hence improves the quality of environment.	110	91.66
Potential Risk		
The development of superweeds that have same resistance properties as the crop by cross-contamination of pollen.	82	68.33
GM crops also affect the human health like food allergies, transfer of less effective antibiotics and other unknown effect.	7	5.83
Toxic effect of herbicides (round up) on ecosystem increase weed tolerant to herbicide and toxic to aquatic organism.	53	44.16
Ethical Concerns		
Monopoly of large multinational companies that control the distribution of GM seeds on world food market.	107	89.16
Animal genes are also used to develop GM crop that pose ethical and religious problem.	0	0
New GM organisms could be patented and thus life could become a commercial property through patenting.	77	64.16

under field conditions before release. About 66.66 percent farmers are aware about regulating bodies for biosafety issues related to GM organisms.

Awareness of Farmers about Potential Benefits of GM crops

Little more than half of the farmers are aware about potential benefits of GM crops (53.54 percent). Maximum numbers of farmers (91.66 percent) were aware about reduction in pesticide and herbicide application due to GM crops followed by 82.50 percent of farmers being aware about benefit of GM crops managing devastating pests, weeds and weather conditions. Less number of farmers (25 percent) was aware about increase in farm income due to herbicide tolerant GM seed. Only 15.00 percentages of farmers were aware about future nutritious and healthier GM food like golden rice and soybean. Similar findings were reported by Chong (2005).

Awareness of Farmers about Potential Risks of GM Crops

Awareness of farmers about potential risks of GM crops is least (39.44percent) as compared to other aspects of GM crops. About 68.66 percent of farmers were aware about development of superweeds that have same resistant properties as GM crops. Around 44.00 percent of farmers were aware about toxic effect of herbicides on ecosystem. Only 5.83 percent of farmers were aware about GM crops affecting human health by food allergies, unknown effects etc.

Awareness of Farmers about Ethical Concerns of GM Crops

About half of the farmers (51.1 percent) had awareness about ethical concerns of GM crops. Maximum number of farmers (89.16 percent) had awareness about monopoly of large multinational companies controlling distribution of seeds in world food market. As high as 64.16 percent of farmers were aware that new GM organisms could be patented and life can become commercial property. Altogether none of the farmers were aware about ethical and religious problem due to utilization of animal genes.

The responses to various statements were analyzed and inferences popped out from the Table 2 that majority of farmers had high level of awareness (62.50 percent) followed by medium (21.66 percent) and low (15.83 percent) level of awareness about various aspects of genetically modified crops. The study will delve further into it to have more concrete findings.

Relationship of Profile Characteristic of Farmers with their Awareness towards Genetically Modified Crops

In order to have idea about which socio-personal and socio-psychological variables of farmers influencing the awareness level of farmers towards genetically modified crops, Pearson correlation coefficients were determined. The correlation coefficients of socio-personal and socio-psychological variables of farmers with awareness level are presented in Table 3.

Table 2. Distribution of farmers according to their extent of awareness

Category	Frequency	Percent
Low (4-8)	19	15.83
Medium (9-13)	26	21.66
High (14-18)	75	62.50

Table 3. Correlation of profile characteristics of farmers with awareness about different aspects of GM crops

Independent variables	Correlation (r)
Age	-0.343
Farm experience	-0.347
GM experience	-0.147
Education	0.278
Mass media exposure	0.305**
Extension contacts	0.201**
Progressiveness	0.575***
Risk orientation	0.481***
Innovativeness	0.407
Economic motivation	0.377

**** and ** Significant at 0.01 and 0.05 percent level.*

From a close examination of Table 3, it is clearly evident that out of 10 independent variables, five of the variables had shown a significant linear relationship with total awareness score obtained about various aspects of GM crops. Strong positive correlation with the awareness score was observed in case of risk orientation, progressiveness, extension contacts and mass media exposure. Variables like age, farm experience, and GM experience shows negative relationship with awareness of farmers towards GM crops.

A glimpse at the results presented in Table 3 revealed that increase in age or farm experience doesn't have any relation with awareness value. Education doesn't have much relation with awareness. Variables like risk orientation, progressiveness, mass media exposure and extension contacts were statistically significant and had linear relationship with awareness and vice-versa. As per the correlation, all socio-psychological factors like progressiveness, risk orientation, innovativeness and economic motivation had positive correlation with awareness of the farmer and reverse of this is also true. These socio-psychological variables were also positively related with each other linearly and vice-versa. To delve about it further and to get a concrete idea, much higher statistical analysis technique, multiple regression analysis was used.

Determinants of factors affecting the awareness of farmers towards genetically modified crops by multiple regression analysis

The results of the multiple regression analysis

Table 4. Multiple regression analysis for the factors affecting the awareness of farmers towards genetically modified crops

Independent variables	Regression coefficients	Standard errors	t-value
Intercept	-40.648	19.531	-2.0811***
Age	0.0425	0.2222	0.1913
Farm experience	-0.1528	0.2055	-0.7433
GM experience	-0.4319	0.3727	-1.1588
Education	0.4791	1.1331	0.4228
Mass media exposure	1.6724	0.8876	1.8841**
Extension contacts	1.0523	0.5582	1.8853**
Progressiveness	2.0559	0.7946	2.5871***
Risk orientation	0.9665	0.4719	2.0480***
Innovativeness	0.2875	0.2973	0.9673
Economic motivation	-0.2211	0.6086	-0.3633

****** and ** Significant at 0.01 and 0.05 level.***

indicated that among the fourteen independent variables included for the analysis, four were found to be statistically significant and affect the awareness level of farmers. These variables were mass media exposure (1.8841**), extension contacts (1.8853*), progressiveness (2.5871**) and risk orientation (2.0480**).

All these variables had positive values on the coefficient estimates, indicating that one percent increase in these variables results in one percent increase in level of awareness. With every increase in one unit of risk orientation, the level of awareness of farmers increased by 2.048. The data analysis also showed that progressiveness of farmers also plays a crucial factor as with every increase in progressiveness, awareness level increases by 2.5871. Mass media exposure and extension contacts also increases the awareness by 1.672 and 1.052 with every one unit increase. Regression analysis gives conclusive idea that progressiveness, mass media exposure, risk orientation and innovativeness are important factors that determine awareness level of farmers.

CONCLUSIONS

India, which is having second largest population in the world have to address concerns related to food security, climate change, and rising disease-pest incidence. In order to tackle these challenges, genetically modified crops provides a great solution. There are various traits of GM crops lined up for commercialization. This study, which examines the factors affecting awareness level of the farmers involved in genetically modified crops towards the GM technology, was conducted in Malwa region of Punjab, which is the predominant GM crop growing region of India. Study was carried out by self-structured interview schedule. The results show that the progressiveness, higher mass media exposure, greater risk orientation and innovativeness of cultivators who are producing genetically modified crops in the form of Bt. cotton plays important role in increasing the awareness level of farmers. These GM crops in order to be properly accepted needs the utilizer of technology to be aware about its various aspects. Efforts need to be put forward for proper training of farmers about GM technology and proper biosafety tests and field trials need to be carried out by govt. agencies as private companies suffer from trust deficit. Based on these findings it is clear that policies regarding GM crops must be well targeted to various categories of farmers and must be based on open and honest debate involving all stakeholders and decision should be based on credible scientific information.

REFERENCES

Aerni, P., & Bernauer, T. (2006). Stakeholder attitudes toward GMOs in the Philippines, Mexico, and South Africa: The issue of public trust. *World Development*, *34*(3), 557-575.

Agriculture Punjab. (2015). *Introduction to Punjab.* Retrieved from http://agripb.gov.in/ on 28/06/2016

Amin, L., MdJahi, J., & MdNor, A.R. (2013). Stakeholders' attitude to genetically modified foods and medicine. *The Scientific World Journal*, *2013*(2013), ID: 516742. Retrieved from http://dx.doi.org/10.1155/2013/516742

Gene Campaign and University of Hyderabad. (2009).*People's biotechnology: Knowledge, attitudes, and perceptions towards genetically modified organisms in India.* Gene Campaign (http://genecampaign.org/)and Hyderabad: University of Hyderabad.

Genetically Modified Food. Anonymous. (2015). *Genetically modified crops*. Retrieved fromhttp://en.wikipedia.org/wiki/Genetically_modified_crops on 18/03/2016.

Elum, Z.A., & Sekar, C. (2015). Bt. cotton: Evaluating farmers' perception in Tamil Nadu, India. *International Journal of Agricultural Policy and Research, 3*(5), 236-241.

Hall, C. (2008). Identifying farmer attitudes towards genetically modified (GM) crops in Scotland: Are they pro-or anti-GM? *Geoforum*, *39*(1), 204-212.

Han F., Zhou D., Liu X., Cheng J., Zhang, Q., & Shelton, A.M. (2015). Attitudes in China about crops and foods developed by biotechnology. *PloS one 10*: e0139114.

ISAAA. (2016). *Global status of commercialized biotech/GM crops: 2016*. ISAAA Brief No. 52. ISAAA: Ithaca, NY.

Sanjeev, M.V., & Gangadharappa, N.R. (2006). Trends in Biotechnology awareness, support towards biotechnology applications, willingness to cultivate GM crops and conviction among Indian farmers. In: Abstracts of *International Conference on Biotechnology Approaches for Alleviating Malnutrition and Human Health,* Bangalore, India Pp 136.

WHO. (2014). *Frequently asked questions on genetically modified foods*. Retrieved from http://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified food/en/on 16/03/2016.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 473-478
DOI: 10.5958/2322-0430.2018.00099.9

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Entrepreneurial Behavior of Banana Growers in Durg District of Chhattisgarh

Archit Kumar Nayak[1] and Nahar Singh[2]*

[1]*Research Scholar, and* [2] *Professor and Head, Department of Agricultural Economics, SHUATS, Allahabad-211007*

[*]*Corresponding author's email: archit.iabm@gmail.com*

Received: December 24, 2017 *Manuscript Number: NS-18-31* *Revision Accepted: February 18, 2018*

ABSTRACT

The study was conducted to access the entrepreneurial behaviour of banana growers in Durg district of Chhattisgarh during the year 2017-2018. Entrepreneurial behaviour of the banana growers was assessed on ten entrepreneurial attributes. The findings revealed that majority (62.01 percent) of the banana growers belonged to medium entrepreneurial behaviour category. With regard to attributes of entrepreneurial behavior, majority of the banana growers had medium level of innovativeness (58.33 percent), Decision-making ability (48.50 percent), coordination ability (43.18 percent), risk-taking ability (34.09 percent), knowledge possession (38.64 percent)and leadership (39.40 percent). The variables namely education, land holding, family income and extension participation were found important in influencing the entrepreneurial behaviour of the banana growers. Whereas, age, and farming experience in banana cultivation and occupation had no association with entrepreneurial behaviour of banana growers.

Keywords

Banana growers, correlation, entrepreneurial attributes, entrepreneurial behavior, socio-economic characteristics.

JEL Codes

C81, Q18, Q12, Q19.

INTRODUCTION

Banana (*Musa paradisiacal* L.) is one of the most important horticultural crop of India. Banana is largest produced and maximum consumed fruit crop cultivated in India and accounts for about 39.8 percent of the total fruit production in India (Ramesh *et al.,* 2013). Globally, India ranks first both in terms of area and production of Banana in the world contributing around 15 percent of the total global area under Banana and about 29 percent of the total world's production. The average productivity of Banana in India is 37.90 Mt/ha compared to the world average of 21.20 Mt/ha (National Horticultural Board, 2015). The five important Banana producing states in the country are Maharashtra, Tamil Nadu, Gujarat, Karnataka and Andhra Pradesh. These five states contributes more than 70 percent of total Banana production in the country. According to export numbers released by APEDA (2016), India exported 65,844 tonnes of bananas in 2013-14 against 45,573.23 tonnes in the previous financial year. Though exports to West Asia were high, even UK and France consume Indian bananas.

Banana cultivation plays an important role in Chhattisgarh with largest share of 26.64 percent of the total fruit production in the state. The total area and production of Banana in the state is 25445 ha and 617286 MT in 2015-16 respectively. Banana production in the state has increased at a compound annual growth rate of 37.40 percent while area has grown at the rate of 22.8 percent during 2004-05 to 2015-16. Banana has the highest gains in terms of yield that is 25.73 MT/ha though the yield potential of Chhattisgarh is 44 MT/ha. (CG Horticulture Department). So, there lies a tremendous opportunity in increasing the production and productivity of Banana in the state. Durg district ranks second in the production of Banana in the state with contributing about 9.44percent of total production of banana in the state.

It is now being argued that increase in production, productivity of farms, farm diversification, innovation and development of farmers into self-sustaining individuals requires involvement of the entrepreneurial

qualities among farmers. Factors like the liberalization of the economy have created the right ambiance for growth of entrepreneurs in agriculture (Wankhade *et al.,* 2013). Agricultural Entrepreneurship is a strategic development intervention that has the potential to accelerate the rural development process. Agricultural entrepreneurship is vital for the generation of employment in the rural areas and for promoting incomes and earnings of people (Raju & Raju, 2015). India has vast potential for entrepreneurship development in terms of diversity of rural occupations. Fruit production is one of the promising sectors of entrepreneurship development in India. Development of entrepreneurship ensures optimal utilization of resources and facilities and value addition to product and services. It also helps in developing capability to cope up with the impact of globalization (Kumara *et al.,* 2016). Entrepreneurial behavior can be attributed as the change in knowledge, skills, and attitude of entrepreneurs in the enterprise they have taken up. In the present scenario, in order to meet the demands of growing population as well as the export requirements, the production has to be still increased. However, productivity of different fruits in our country is comparatively lower than the world's average productivity. Hence, entrepreneurship development in agriculture and food sector is a major driver for promoting and sustaining the momentum of growth and providing employment.

However, despite the recognition that entrepreneurship is one of the primary aspect through which rural economic development can be achieved, empirical research on entrepreneurial and organizational competency in banana growers is relatively sparse and this concept remains largely unknown (Wolf *et al.,* 2007). An appreciation of this phenomenon may expand the conceptual understanding of farming as entrepreneurship and help formulate realistic agricultural policies. It is therefore imperative that scientific research looks into the aspects of agricultural entrepreneurship and promotes the "fruit growers". Researchers in the past have dealt with farmers in relation to farm productivity. However, study on entrepreneurial behavior of banana growers has not been done in banana especially in Chhattisgarh. In this backdrop, the present study entitled Entrepreneurial Behavior of Banana Growers in Durg district of Chhattisgarh is undertaken with the specific objectives of measuring the entrepreneurial behavior of banana growers as well as exploring the relationship between the personal and socio-economic characteristics of banana growers with their entrepreneurial behaviour.

DATA AND METHODOLOGY

The study was conducted in Dhamdha block of Durg district of Chhattisgarh state during the year 2016-17. Multi-stage random sampling design was used for the selection of sample. Durg district was selected purposively for the study since it is the second highest producer of Banana in the state. Further, Dhamdha block was purposively selected in proportion to the highest area under banana cultivation. Subsequently, eight villages having the highest area under banana cultivation were selected from the sampled block. A sample of 20 percent Banana cultivators were selected randomly from each selected village. Altogether, a sample of 132 banana growers were selected for the present study. Descriptive research design was employed for conducting the study. The data was collected from these 132 banana growers through personal interview and was analyzed by using suitable statistical techniques.

For measuring the entrepreneurial characteristics of banana growers a function oftensubcomponents (Nandapurkar, 1980) were taken viz., innovativeness, achievement motivation, decision making, ability to coordinate farm activities, risk-taking ability, knowledge of farming enterprise, information seeking behaviour, assistance of management service, leadership ability and cosmopolites. So, the overall entrepreneurial behavior score of the respondents was worked out by summing up the scores obtained by them on each of these ten attributes. Based on the total score on individual components of entrepreneurial characteristics, the respondents have been grouped into the following three levels of entrepreneurship, keeping the mean and standard deviation (SD) of the scores as check:

1. Low: respondents scoring < Mean-SD;
2. Medium: respondents scoring between Mean-SD and Mean+SD;
3. High: respondents scoring >Mean+SD.

RESULTS AND DISCUSSIONS

Socio-economic Characteristics of the Sampled Banana Growers

The distribution of banana farmers according to their socio-economic, and personal characteristics is presented in Table 1. It is observed from Table1 that the respondents within the young age group (18 to 35 years) category are 46 in number which accounts for about 34.84percent. The respondents having the age between 36-50 years were highest in number (62.00) which accounted for 46.96 percent and the respondents in the old age category of above 50 years were 24 in number which is nearly 18.18percent. The educational status of the sampled banana growers which indicates that the only 8.33 percent of the banana growers were illiterates while 16.67 percent of them attended primary school, 22.73 percent of them availed secondary education, 31.06 percent of growers attended higher secondary education and 21.21 percent of growers were graduate and above. This shows that the level of education of the sampled banana growers was good as maximum number of banana grower availed higher secondary education followed by secondary education and graduate. The distribution of respondents according to the landholding size reveals that 45.45 percent of the banana growers in the study area belong to the medium farm size (1.2 to 2 ha) followed by 30.30 percent growers which belongs to large farm size

Table 1. Distribution of respondents according to their socioeconomic status

(n_1=132)

Category	Frequency	Percentage
Age		
Young Age (18-35)	46	34.84
Middle Age (36-50)	62	46.96
Old Age (above 50)	24	18.18
Educational status		
Illiterate	21	15.91
Primary Education	21	15.91
Secondary Education	29	21.97
Higher Secondary	34	25.76
Graduate and above	27	20.45
Landholding		
Small (0-1 ha)	32	24.24
Medium (1.1-2 ha)	60	45.45
Large (Above 2 ha)	40	30.30
Farming experience in banana		
1-10 years	72	54.55
11-20 years	40	30.30
> 20 years	20	15.15
Occupation		
Primary	68	51.52
Secondary	38	28.79
Tertiary	26	19.70
Extension participation		
Low (0-2)	37	28.03
Medium (3-5)	70	53.03
High (above 5)	25	18.94
Family income (₹lakhs)		
Less than 2	39	29.55
2-4	52	39.39
Above 4	41	31.06

category (Above 2 ha) while only 24.24 percent of the banana growers have small farm size category (0 to 1 ha). It indicates that the banana farming is more prominent in medium and large farm size groups. The farming experience of banana growers shows that the majority of the growers (54.55 percent) had farming experience of 1-10 years, about 30.30 percent of them had 11-20 years of experience and about 15.15 banana growers had experience 20 years and above. The results clearly indicates that the banana farming has gained much popularity in the recent decade. The results on occupational status of respondents indicated that majority (54.54 percent) of the respondents were dependent solely on Farming (Agriculture, Horticulture). Whereas, 28.80 percent of respondents were practicing agricultural along with subsidiary enterprises like dairy, poultry and only 16.66 percent of respondents were practicing agricultural and subsidiary enterprises in addition to other sources of income like laborer and retail shops. More than half of the respondents (53.03 percent)falls under medium category of extension participation that is participation in the extension activities such as training programmes, demonstrations, Krishi Mela, exhibitions, field visit, etc., and 28 .03 percent of them had have low extension participation whereas 18.94 percent of the banana growers were having extension participation. The income of the banana growers through the banana produce in Table 1. The Table 1 clearly depicts that the majority (39.40 percent) of the banana growers were having annual income between 2-4 lakhs followed by 31.06 percent of them earning annual income of more than 4 lakhs and only 29.55 percent of the banana growers having annual income of less than 2 lakhs.

Entrepreneurial Behaviour of the Banana Growers

Table 2 presents the entrepreneurial behavior of the banana grower with respect to ten attributes viz. innovativeness, achievement motivation, decision making, ability to coordinate farm activities, risk-taking ability, knowledge of farming enterprise, information seeking behaviour, assistance of management service, leadership ability and cosmopoliteness. The result revealed that more than half (62.01percent) of the respondents belonged to medium entrepreneurial behaviour category. Whereas, 20.69 percent of them in low entrepreneurial behaviour category and 17.29 percent had high entrepreneurial behaviour. The results are in accordance with the findings of Wankhade *et al.* (2013); Kumara *et al.*(2015); Chandramouli *et al.* (2007); Wanole*et al.* (2017). With regard to Innovativeness, it is observed that more than half (58.33 percent) of the banana growers had medium levels of innovativeness followed by low (26.88 percent) and high (18.18 percent) innovativeness level. The findings are in line with the studies of Hendge *et al.* (2007); Borate *et al.* (2010). With respect to achievement motivation, majority (40.91 percent) of the banana growers had high achievement motivation followed by medium (34.85 percent) and low (24.24 percent) achievement motivation. With regard to decision-making ability, little less than half (48.50 percent) of the banana growers had medium decision-making ability followed by high (29.55 percent) and low (21.95 percent) level of decision-making ability. The findings are in agreement with the studies conducted by Mehta & Sonawane (2012). In the context of coordination ability, 43.18 and 37.12 percent of the banana growers had medium and high coordination ability respectively, followed by 19.70 percent of the low level of coordinating ability. The results are in congruence with the findings of Kumara *et al.* (2015); Ravikumar *et al.* (2013). With regard to risk-taking ability, majority (40.15 percent) of the banana growers had high risk taking ability followed by medium (34.09 percent) and low (25.46 percent) risk-taking ability. As regard to the knowledge possession of the farm practices, 38.64 percent of the banana growers had medium level of knowledge possession followed by low (37.12 percent) and high level (24.24 percent) of

Table 2. Distribution of banana growers by entrepreneurial attributes

Entrepreneurial attributes	Frequency	Percentage
Innovativeness (Score)		
Low (<15.46)	31	23.48
Medium (15.46-20.21)	77	58.33
High (>20.21)	24	18.18
Achievement motivation (Score)		
Low (<2.40)	32	24.24
Medium (2.40-4.98)	46	34.85
High (>4.98)	54	40.91
Decision-making ability (Score)		
Low (<5.25)	29	21.95
Medium (5.25-8.96)	64	48.50
High (>8.96)	39	29.55
Ability to coordinate (Score)		
Low (<5.61)	26	19.70
Medium (5.61-8.96)	57	43.18
High (>8.96)	49	37.12
Risk taking ability (Score)		
Low (<5.03)	34	25.76
Medium (5.03-8.97)	45	34.09
High (>8.97)	53	40.15
Knowledge possession (Score)		
Low (<1.99)	49	37.12
Medium (1.99-3.89)	51	38.64
High (>3.89)	32	24.24
Information seeking (Score)		
Low (<12.39)	29	21.97
Medium (12.39-15.94)	45	34.09
High (>15.94)	58	43.94
Assistance of management services (Score)		
Low (<2.04)	58	43.94
Medium (2.04-7.40)	49	37.12
High (>7.40)	25	18.94
Leadership (Score)		
Low (<2.48)	33	25.00
Medium (2.48-7.82)	52	39.40
High (>7.82)	47	35.60
Cosmopolites (Score)		
Low (<1.00)	61	46.21
Medium (1.00-3.35)	56	42.42
High (>3.35)	20	15.15
Overall entrepreneurial behavior (Score)		
Low (<6.36)	26	19.70
Medium (6.36-8.06)	82	62.12
High (>8.06)	24	18.18

knowledge possession. These findings are incongruence with the findings of Kumara *et al.* (2016); Wankhade *et al.* (2013). The findings regarding information seeking behavior of the banana growers revealed that the majority of the growers (43.94 percent) were having high information seeking behaviour whereas 34.09 percent and 21.97 percent of the growers had medium and low level of information seeking behaviour, respectively. From Table 2, it is evident that majority (43.94 percent) of the banana growers had low assistance of management service followed by medium (37.12 percent) and high (18.94 percent) assistance of management service, respectively. With regard to leadership ability, majority (39.40 percent) of the banana growers had medium level of leadership ability followed by high (35.60 percent) and low (25.00 percent) level of leadership ability respectively. With respect to the cosmopoliteness, it is observed that majority (46.21 percent) of the growers had low level of cosmopoliteness followed by medium (42.42 percent) and high (15.15 percent) level of cosmopoliteness, respectively.

Relationship between Personal and Socio-economic Characteristics and Overall Entrepreneurial Behavior of the Banana Growers

The relationship between the personal and socioeconomic characteristics of the banana growers and their entrepreneurial behaviour was assessed using correlation coefficient (r). The result in this regard is presented in Table 3. The correlation confirmed that the variables viz., education, land holding, family income and extension participation showed positive and significant relationship at 0.05 level of probability. The variables like age, occupation and farming experience of banana growers had negative and non-significant relationship with entrepreneurial behaviour. Education broaden their mental horizon which lead them to take better decisions. Thus education was one of the influencing factor for entrepreneurial behaviour of banana growers. The results are in accordance with the findings of Kumar (2012) and Mehta & Sonawane (2012). As a large majority of banana growers were engaged in agriculture alone. Hence, less variation in their occupation might be the reason for the non significant relationship of the occupation with the entrepreneurial behaviour of the banana growers. The results are in accordance with the findings of Nagesh (2006); Kumara *et al.* (2015). Landholding provides the

Table 3. Correlation between personal and socio-economic characteristics and entrepreneurial behavior of Banana growers

(N=132)

Independent variables	'r' value
Age	-0.05^{NS}
Education	0.28^{**}
Occupation	-0.16^{NS}
Landholding	0.26^{**}
Family income	0.22^{**}
Farming experience in banana cultivation	-0.06^{NS}
Extension participation	0.21^{**}

***** Significant at 0.05 level probability.***
NS: Non-significant.

economic support to the banana growers to practice new agricultural technologies and leads to efficient production and marketing of the product and also helps to bear risk and uncertainty in his ventures. Hence, land holding of banana growers was positively and significantly correlated. The results are in accordance with the findings of Kumar (2012). Annual family income of banana growers was positively and significantly correlated with the entrepreneurial behaviour of the banana growers. The positive and significant relationship indicates that a higher income in banana cultivation led to increase in their entrepreneurial behaviour through higher purchasing power and as a result have an urge to seek new technologies for improving their income and standard of living. The results are in accordance with the findings of Kumar (2012); Mehta & Sonawane (2012); Borate *et al.* (2010). It was found that extension participation had positively and significantly correlated with their entrepreneurial behaviour as these participations in the extension activities such as training programmes, demonstrations, Krishi Mela, exhibitions, field visit, etc., encourages them to take right decisions leading them to better entrepreneurial behaviour. The results are in accordance with the findings of Manjunath *et al.* (2015); Nagesh (2006). The remaining variables namely, age, occupation and overall farming experience of banana growers had negative and non-significant relationship with entrepreneurial behaviour. It means that there was no influence of age, occupation and overall farming experience on entrepreneurial behaviour of banana growers.

CONCLUSIONS

Findings of the study clearly revealed that majority of the banana grower belonged to medium category of entrepreneurial behaviour which indicates the contribution and significance of these entrepreneurial attributes in realizing entrepreneurship among banana growers. Majority of the banana growers had medium level of innovativeness, decision-making ability, coordination ability, risk-taking ability, knowledge possession and leadership whereas entrepreneurial attributes like assistance of management services and cosmopoliteness were found low in the banana growers. The variables like education, land holding, family income and extension participation were found important in influencing the entrepreneurial behaviour of the banana growers which signify that an improvement in these personal characteristics could positively impact the entrepreneurial behaviour of banana growers. The present study has emphasized the need to improve the knowledge level of the banana growers with respect to modern cultivation practices and technologies through effective extension programmes such as training programmes, demonstrations, Krishi Mela, exhibitions, field visit, etc. there by bringing innovations in the farming technologies to raise the productivity of the banana farms. It is the need of the hour to provide the banana growers with the efficient assistance services in the form of easy availability of finance, improving marketing system and promoting co-operatives backed by policy support for taking up entrepreneurial activities.

REFERENCES

APEDA. (2016). Agricultural Processed Products Export Development Authority. Retrieved from www.apeda.gov.in

Borate, H.V., Mahadik, R.P., & Kokate, K.D. (2010). Entrepreneurial behaviour of mango growers. *Journal of Community Mobilization and Sustainable Dev*elopment, *5*(2), 69-73.

Chandramouli, P., Meti, S.K., Hirevenkanagoudar, L.V., & Hanchinal, S.N. (2007). Comparative analysis of entrepreneurial behaviour of farmers in irrigated and dryland areas of Raichur district of Karnataka. *Karnataka Journal of Agricultural Sciences*. 20(2), 320-321.

Hendge, Y.G., Patil, R.P., More, S.S., & More, P.S. (2007). A study of entrepreneurial behaviour of banana growers in Nanded district. *Journal of Soils and Crops, 17*(1), 153-157.

Kumar, N.P. (2012) *Entrepreneurial behaviour of pomegranate farmers in Chitradurga district of Karnataka* (Master's Thesis). University Agricultural Sciences, Bangalore, Karnataka, India.

Kumara, N., Nehal Farooquee, A.N., & Sasidhar, P.V.K. (2016). Entrepreneurial behaviour of vegetable growers in Karnataka. *Indian Journal of Economics and Development, 12*(2), 369-376.

Manjunath, Amaresh Kumar, K., & Shashikala Bai, D. (2015). Influence of personal and socio-economic attributes of mango growers on their entrepreneurial behaviour. *International Journal of Tropical Agriculture*, *33*(4): 2975-2979.

Mehta, B.M., & Sonawane, M. (2012). Entrepreneurial behaviour of mango growers of valsad district of Gujarat State. *Indian Research Journal of Extension Education*, *12*(1), 78-82.

Nagesh (2006) *Study on entrepreneurial behaviour of pomegranate growers in Bagalkot district of Karnataka* (Master's Thesis).University Agricultural Sciences, Dharwad, Karnataka, India.

Nandapurkar, G.G., (1980). *A study of the entrepreneurial behavior of small farmers* (Doctoral Thesis). U.A.S., Bangalore.

National Horticultural Board. (2015). *Data base*. National Horticultural Board. Retrieved from http:// nhb.gov.in/

Raju, B.I., & Raju, M.L. (2015). Agricultural entrepreneurship-An Indian perspective, Paripex. *Indian Journal of Research*. *4*(9), 118-119.

Ramesh, G.B., Gajanana, T.M., & Umesh, T.M. (2013). Marketing practices and post-harvest losses in banana (Var. Robusta) - A study in Shimoga district, Karnataka. *Indian Journal of Agricultural Marketing*. (Conf. Spl.), *27*(3), 116-122.

Ravikumar, D. Modi, Bhemappa, A., Manjunath, A.L., Hedge, R.V., & Havaldar, Y.N. (2013). Entrepreneurial characteristics of mango growers and their constraints in adoption of post-harvest management practices in mango. *Karnataka Journal of Agricultural Sciences*, *26*(3), 384-387.

Wankhade, R.P., Sagane, M.A., & Mankar, D.M. (2013).

Entrepreneurial behaviour of vegetable growers. *Agricultural Science Digest*, *33*(2), 85- 91.

Wanole, S.N., Khalge, M.I., & Dhulgand, V.G. (2017). Entrepreneurial behavior of banana growers. *TECHNOFAME- A Journal of Multidisciplinary Advance Research*, *6* (1), 76- 79.

Wolf, G.A., McElwee, G., & Schoorlemmer. H.B. (2007). The European farm entrepreneur: A comparative perspective. *International Journal of Entrepreneurship and Small Business, 4*(6), 679-692.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 479-485
DOI: 10.5958/2322-0430.2018.00100.2

NAAS Score: 4.82
www.naasindia.org
UGC Approved

An Analysis of Occupational Gap: Duncan Dissimilarity Approach

Jaspil Kaur

Research Scholar, Department of Economics, Punjabi University, Patiala-147002

E-mail: kaur.sangrur123@gmail.com

Received: December 03, 2017 *Manuscript Number: NS-18-41* *Revision Accepted: February 13, 2018*

ABSTRACT

The main objective of this paper is to analyse the magnitude of job segregation among male and female workers in India. For this purpose, firstly the simple dissimilarity index introduced by Duncan and Duncan will be applied. An underlying assumption in the index is that segregation leads to a different distribution of women and men across occupations. This measure denotes the share of the employed population that would need to change the occupation in order to restore equality in the distribution of men and women among various occupations. Duncan index distinguishes the occupations by gender, and the empirical difference prevailing in the occupational composition of labourers is observed; as the results indicate that the high value adding occupations are mainly dominated by substantial fractions of male workers in India. Consequently, this skewness of jobs in favour of male workers and unequal division of labour, adversely affects the labour market and perpetuates imbalances and dualism. Capitalism and the patriarchal system have a powerful control over the labour market and production process and therefore invigorate exclusion, exploitation and hierarchies. The occupational gap and constraints among the workers acts as catalyst in dividing the labour market into various segments. Secondly, the poverty estimation of workers in various occupations among different social groups will also be enumerated based on the Expert Group methodology of Tendulkar Committee. The occupational gender segregation analysis provides an insight that female workers are mainly engaged with primary sector activities and they are preferred for domestic works and child caring; therefore these activities have lower upward mobility and thus traps the female workers in poverty. On contrary, the present study will also explore the relationship between the occupational differentials by caste and poverty.

Keywords
Discrimination, labour market, occupation, poverty, workers.

JEL Codes
C82, C52, I32, J24, J62.

INTRODUCTION

Before capitalism, a patriarchal system was established in which men controlled the labour of women and children in family, and that in so doing men learned the techniques of hierarchical organization and control. The radical view, in particular, emphasizes the role of men as capitalist in creating hierarchies in production process in order to maintain their power. The resulting mutual accommodation between patriarchy and capitalism has created a vicious circle for women (Hartmann, 1976). Market failure associated with economic discrimination leads to lower economic growth, inequality in income, poverty and inter-group conflict (Thorat & Newman, 2007). On the labour supply side, the theories stress the lower levels of female human capital. Investment in human capital influence future real income through the embedding of resources in people (Becker, 1985). While some level of inequality is a natural outcome of heterogeneity in personal characteristics, providing incentives for people to invest in education and make efforts at work, high and rising income inequality can become an obstacle to "equality of opportunity" and lead to less social mobility. With high inequality, economic advantage is more likely to be inherited than earned (Corak, 2013).

Social and individual efficiency requires society to develop the capacity of an individual to the point of competency to choose and to make his own career. This principle is violated in the caste system, in so far as it involves an attempt to appoint tasks to individuals in

advance; selected not on the basis of trained original capacities, but on that of the social status of the parents. This stratification of occupations is positively pernicious and results in the caste system. By not permitting readjustment of occupations, caste becomes a direct cause of much of the unemployment we observe in the country (Ambedkar, 1936).The division of labour brought about by caste system is not a division based on choice. Individual sentiment, individual preference, has no place in it. It is based on the dogma of predestination. As an economic organization caste is, therefore, a harmful institution, in as much as it involves the subordination of man's natural powers and inclinations to the exigencies of social rules.

If equal work is interpreted as equal disutility, in the sense of fatigue or privation of amenity, then equal pay may be interpreted equal satisfaction obtained from earnings. Equality in this sense is not always predictable of equal external prerequisites (Edgeworth, 1922). It is not that lower caste people have earned such isolation; they experience absolute exclusion from the cradle to the grave, the exclusion extends to the economic realms of wages, jobs, education, and land (Narula & Macwan, 2001). Casteism is the powerful force for the redressal of inequalities and exploitation engendered traditionally, complex system of segregation. Thus the theories of caste are mainly confined to the ancient literature. The notions of hierarchy and hereditary occupational specialization are intrinsically owed to the 'separation', 'repulsion' or 'recognition of differences' (Jaiswal, 1998).

Duncan (1969) asserted that poverty stems largely not from the legacy of poverty but from the legacy of race. Inequality measures examine the relative positions of individuals in the distribution in a society of whatever inequality measure (of income, consumption, particular commodities such as food, health service, etc.). Moreover, Poverty also analyze an individual's position relative to some absolute norm and assessing the distribution of the individuals in the society (Srinivasan, 2013). Indian poverty lines are held constant in real terms and are updated over time using versions of the CPIAL (Consumer Price Index-Agricultural labourers) and CPI-IW (Consumer Price Index-Industrial workers) that are re-weighted to reflect the higher than average share of food among those close to the poverty line (Deaton, 2008).

Segregation index measure the process of segregation or change in segregation pattern. Segregation of two different groups can be attributed to differences between their income, occupational status, etc. It is also examined that whether changes in degree of segregation over a given time period is related to changes in these variables (Duncan & Duncan, 1995).

The Duncan index represents the share of either group which must be removed without replacement to achieve zero segregation (Siltanen, 1990; Watts, 1992). The measures of segregation over time should not be distorted by changes in the sexual shares, a non-zero Gender Effect. It is asserted that the distribution of individuals across occupations can be varied between complete segregation and zero segregation. The mean value of the index reflects the sexual shares of employment in each occupation. Dissimilarity Index (ID) clearly reveals Gender Symmetry, and also represents the share of female employees who must be removed from female-dominated occupations. There is a zero Gender Effect (Composition Invariance) because uniform percentage increases in the number of males and females in each occupation leaves each ratio in unchanged for each occupation (Cortese *et al*., 1976; James & Taeuber, 1985).

DATA SOURCE AND METHODOLOGY

The present study will explain the structure and scenario of occupational segregation in Indian labour market. The analysis is based on nationally represented unit level secondary data of 68th round (2011-12) from Employment and Unemployment Survey, conducted by National Sample Survey (NSS). The occupational classification is based on National Industrial Classification (NIC 2008) and National Occupational Classifications (NCO 2004). This study will figure out the magnitude of discrimination in Indian labour market both by gender and caste.

In the present study to measure the gender occupational segregation the popular Duncan's index of dissimilarity (ID) is applied. The equation for Duncan and Duncan simple dissimilarity index (ID) is

$$ID \quad \frac{1}{2} \quad {}_{j\ 1}^{n} \left| f_j / f \quad m_j / m \right| \ 100$$

Where, *mj* and *fj* is the share of male and female in the *j*th occupation (*j*ranges from 1 to n, where n is total number of occupations).

f= Total number of females in labour force

m= Total number of males in labour force

The ID index lies between 0 and 100 in percentage terms where the extreme values point to complete equality and inequality respectively. An underlying assumption in the index is that segregation leads to a different distribution of women and men across occupations. This measure denotes the share of the employed population that would need to change the occupation in order to restore equality in the distribution of men and women among various occupations.

Poverty Estimation

The consumption poverty line is the reference poverty line basket (PLB) of household goods and services consumed by those households at the borderline separating the poor from the non-poor.

The poverty estimations applied in the study are consumption based, where

$$\text{MPCE} = \frac{\text{Value of Consumption per month}}{\text{Household Size}}$$

Where MPCE is Monthly Per Capita Consumption Expenditure

The poverty estimation among workers based on different social group will also be enumerated based on the Expert Group methodology of Tendulkar Committee. The national poverty line for the year 2011-12, for rural areas using the Tendulkar methodology, is estimated at ₹816 per capita per month and ₹1,000 per capita per month in urban areas.

Main Objectives

The phenomenon of occupational segregation has a prominent role in the identification and explanation of inequality in the labour market. The general root causes of occupational segregation are social, economic, cultural and historic. They determine both the extent and patterns of occupational segregation around the world.

The distinctive objectives of this study are as follows:

i. to examine the extent of occupational gender segregation,
ii. to examine the occupational pattern among different social groups, and
iii. to assess the inter-relationship between caste and poverty.

Duncan Dissimilarity Index of Segregation

According to the definitions of NSSO, self-employed persons operate their own farm or non-farm enterprise and thus are engaged independently in a profession or trade on own-account. Own account workers are those self-employed persons who operated their enterprises on their own account or with one or few partners and who, during the reference period, by and large, run their enterprise without hiring any labour. They could, however, have had unpaid helpers to assist them in the activity of the enterprise. On the other hand, employers are those self-employed persons who worked on their own account or with one or a few partners and, who run their enterprise by hiring labour. Unpaid family workers are mostly family workers who are engaged in their household enterprises, working full or part-time and did not receive any regular salary or wages in return. The persons who worked in other's farm or non-farm enterprises and in return receive salary are regular salaried/ wage employee. A person who is casually engaged in other's farm or non-farm enterprises and receives wages according to the terms of the daily or periodic work contract is a casual wage labour.

The index of dissimilarity (ID) for occupational segregation computed for the year 2011-12 is given in Table 1 and 2. The index value in Table 1 clearly depicts that segregation by gender is highest for regular salaried/wage employee (43.99 percent), followed by labour in the other types of work (28.57 percent) and own account workers (26.82 percent) respectively. Unpaid family workers (11.86 percent) and casual wage labour (14.64 percent) are the least segregated jobs. The index of dissimilarity for India is 24.27 which depicts that 24.27 percent of workers would have to change the occupations to make the occupational distribution equal in the Indian labour market.

Table 1. Duncan Index on various activity statuses, 2011-12

(Percent)

Activity status	ID (Duncan Index)
Worked in household enterprise (self-employed): own account workers	26.82
Employer	22.75
Worked as helper in household enterprise (unpaid family worker)	11.86
Worked as regular salaried/wage employee	43.99
Worked as casual wage labour	14.64
In other types of work	28.57
All India	24.27

Source: Calculated from unit level data, 68th Round, (NSSO 2011-12).

Table 2. Duncan Index for various occupations

(Percent)

Occupations	ID (Duncan Index)
Elementary occupations	18.91
Craft and related trades workers	47.03
Professionals	38.23
Technicians and associate professionals	37.86
Plant and machine operators and assemblers	55.34
Service workers and shop & market sales workers	20.26
All India	24.27

Source: Calculated from unit level data, 68th Round, (NSSO 2011-12).

The Duncan index of dissimilarity (ID) for various occupations is also computed for the year 2011-12 is given in Table 2. The elementary occupations cover the street vendors, shoe cleaning, domestic and related helpers, cleaners, launders, building caretakers, garbage collectors, mining, and construction, etc., and the Index value for these occupations is 18.91 percent. The index is highest among plant and machine operators and assemblers (55.34 percent) that include mining and mineral processing plant operators, metal processing plant operators, wood processing and papermaking plant operators, chemical operating plant operators, motor vehicle drivers, ship's deck crew, etc. The segregation estimation by Duncan Index is also large among professionals that also amounts to physical, mathematical, engineering, statisticians, life sciences, health, teaching, business professionals. Furthermore, the corresponding Index for technicians and associate professionals is 37.86 percent; that means 37.86 percent of workers would have to change the occupations to make the occupational distribution equal. Therefore, it is

observed that high status and high value adding sectors, professions are mainly dominated by the male workers.

Such redistribution is not always a practical one from the point of view of carrying out a desegregation program, but this expression for the index has been popular. The methodological analysis of segregation indices by Duncan and Duncan is a classic piece. Some of the drawbacks studied by prominent scholars are that Duncan and Duncan did not attempt to construct a formal set of criteria by which the viability of segregation indices could be judged. In particular, they point out that some indices are sensitive to population parameters which are not themselves indicators of segregation. In their investigation, the important parameter is the racial composition of the total population, and some indices are shown to vary with changes in this parameter when the segregation curve remains constant. They conclude that indices which are affected in this way would not yield meaningful comparisons when the relevant population parameters vary (Siltanen, 1990; Sakoda; 1981).

Occupational Pattern among Different Social Groups

The occupational distribution is highly skewed with aunder-representation of workers from Scheduled Castes (SC), Scheduled Tribes (ST) and Other Backward Classes (OBC) in professional and technical occupations. Though majority of the SC, ST, and OBC workers are engaged in primary sector occupations of agriculture, forestry and fishing, but they neither have better access, control and ownership of land and other productive resources, nor do they have access to market or a role in decision making. The lack of ownership of productive inputs have naturally impaired their access to facilities like credit, subsidies and have rendered them more vulnerable to economic vagaries.

Table 3. Share of each occupation in employment by caste

(Percent)

NCO Sub division code 2004	Occupations	Scheduled Tribes (ST)	Scheduled Castes (SC)	OBC	Others	Total share
11	Legislators and senior officials	0.01	0.01	0.03	0.07	0.12
12	Corporate managers	0.27	0.62	2.75	2.78	6.42
13	General managers	0.00	0.00	0.04	0.07	0.11
21	Physical, mathematical and engineering science	0.01	0.04	0.19	0.35	0.59
22	Life science and health professionals	0.01	0.04	0.09	0.18	0.32
23	Teaching professionals	0.05	0.11	0.39	0.53	1.08
24	Other professionals	0.05	0.15	0.43	0.72	1.35
31	Physical and engineering science associate professionals	0.01	0.06	0.13	0.19	0.39
32	Life science and health associate professionals	0.03	0.07	0.16	0.14	0.40
33	Teaching associate professionals	0.11	0.14	0.40	0.45	1.10
34	Other associate professionals	0.03	0.12	0.38	0.53	1.06
41	Office clerks	0.09	0.22	0.52	0.71	1.53
42	Customer services clerks	0.01	0.04	0.09	0.12	0.26
51	Personal and protective service workers	0.15	0.04	1.22	0.67	2.08
52	Models, sales persons and demonstrators	0.20	0.53	2.04	1.99	4.75
61	Market-oriented skilled agricultural and fishery workers	4.57	3.42	12.8	7.32	28.12
62	Subsistence agricultural and fishery workers	0.07	0.31	1.07	0.12	1.57
71	Extraction and building trades workers	0.51	1.81	2.80	1.21	6.34
72	Metal, machinery and related trades workers	0.06	0.33	1.06	0.54	1.99
73	Precision, handicraft, printing and related trades workers	0.02	0.11	0.42	0.19	0.75
74	Other craft and related trades workers	0.12	0.72	2.08	1.24	4.16
81	Stationary-plant and related operators	0.02	0.11	0.20	0.19	0.53
82	Machine operators and assemblers	0.04	0.20	0.70	0.61	1.56
83	Drivers and mobile plant operators	0.11	0.49	1.23	0.78	2.60
91	Sales and service elementary occupations	0.14	0.86	1.15	0.68	2.83
92	Agricultural, fishery and related labourers	2.88	6.24	8.16	2.66	19.94
93	Labourers in mining, construction, manufacturing and transport	0.96	2.72	3.12	1.25	8.05
Total		10.53	19.51	43.6	26.29	100.00

Source: Calculated from unit level data, 68th Round, (NSSO 2011-12).

The Share of each occupation in employment by caste is illustrated in Table 6. The proportional share in in legislators and senior officials for ST, SC, OBC and Others 0.01, 0.01, 0.03 and 0.07 percent , likewise for corporate manger their share is 0.27, 0.62, 2.75 and 2.78 percent and general manager are found only to be associated with OBC (0.04 percent) and Others (0.07 percent). The occupational share of ST (0.01 percent) in physical, mathematical and engineering sciences is lowest, followed by SC (0.04 percent), OBC (0.35 percent) and Others (0.35 percent) respectively. Furthermore, the occupational share in Other associate professionals officials for ST, SC, OBC and Others 0.03, 0.12, 0.38 and 0.53 percent respectively, these occupations constitute finance and sale professionals, business services agents, and trade brokers, administrative professionals, customs, tax and related government associate professionals, police inspectors and detectives, artistic, entertainment and sports professionals. Moreover, the office clerks share for Others (0.71 percent) is higher as compared to SC (0.09 percent), ST (0.22 percent) and OBC (0.52 percent). The office clerks mainly covers the secretaries and key board operating clerks, numerical clerks, material recording and transport clerks, library, mail and related clerks. In comparison the agricultural, fishery and related labourers share is higher for OBC (8.16 percent), followed by ST (6.24 percent), SC (2.88 percent) and others (2.66 percent). Likewise, the work at mining, construction, manufacturing, and transport is mainly shared by ST workers (2.72 percent) and OBC (3.12 percent).

It is noteworthy that the high status and highly paid

Table 4. Employment share in each occupation by caste

(Percent)

NCO Sub Division Code 2004	Occupations	ST	SC	OBC	Others
11	Legislators and senior officials	6.82	10.68	26.69	55.81
12	Corporate managers	4.23	9.63	42.89	43.25
13	General managers	4.21	3.23	32.40	60.15
21	Physical, mathematical and engineering science	1.63	7.12	32.39	58.86
22	Life science and health professionals	2.16	11.69	28.95	57.19
23	Teaching professionals	4.48	10.25	36.48	48.79
24	Other professionals	3.69	11.41	31.82	53.08
31	Physical and engineering science associate professionals	3.69	15.54	32.93	47.83
32	Life science and health associate professionals	8.11	16.25	39.81	35.83
33	Teaching associate professionals	9.70	13.17	36.48	40.64
34	Other associate professionals	3.19	11.19	36.08	49.55
41	Office clerks	5.93	14.10	33.83	46.13
42	Customer services clerks	1.76	14.14	35.56	48.55
51	Personal and protective service workers	6.99	1.90	58.63	32.48
52	Models, sales persons and demonstrators	4.24	11.17	42.82	41.78
61	Market-oriented skilled agricultural and fishery workers	16.24	12.16	45.54	26.05
62	Subsistence agricultural and fishery workers	4.30	19.62	68.30	7.78
71	Extraction and building trades workers	8.12	28.58	44.18	19.13
72	Metal, machinery and related trades workers	2.79	16.60	53.18	27.42
73	Precision, handicraft, printing and related trades workers	2.56	15.07	56.64	25.73
74	Other craft and related trades workers	2.92	17.37	49.90	29.81
81	Stationary-plant and related operators	3.72	21.19	38.46	36.63
82	Machine operators and assemblers	2.79	12.86	45.07	39.28
83	Drivers and mobile plant operators	4.06	18.85	47.33	29.77
91	Sales and service elementary occupations	5.04	30.27	40.68	24.01
92	Agricultural, fishery and related labourers	14.44	31.27	40.93	13.36
93	Labourers in mining, construction, manufacturing, and transport	11.96	33.75	38.77	15.52
Total		10.53	19.51	43.67	26.29

Source: Calculated from unit level data, 68th Round, (NSSO 2011-12).

Table 5. Percentage of workers living below poverty line: Caste-wise

MPCE	Caste	Percentage BPL
Rural workers below poverty line		
Expert group Tendulkar	ST	48.86
(Rural poverty line)	SC	33.41
<₹816 MPCE	OBC	25.62
	Others	17.38
Urban workers below poverty line		
(Urban poverty line)	ST	28.32
<₹1000 MPCE	SC	23.48
	OBC	17.24
	Others	9.07

occupations are mainly concentrated by 'Other' caste (upper caste) people. Due to these occupational segregations and discriminations in labour market lower castes have the highest incidence of poverty in India.The large mass of poor households and those belonging to socially marginalized groups supply unskilled manual labour, while skilled and managerial workers mainly come from higher socio-economic classes.

The employment share in Table 7 estimates that the proportional share of ST workers in legislators and senior officials, corporate managers, general managers, physical and engineering science, life science and health professionals is 6.82, 4.23, 4.21, 1.63 and 2.16 percent respectively. Likewise, the corresponding figures for SC workers are 10.68, 9.63, 3.23, 7.12 and 11.69 percent, the share of OBC workers is 26.69, 42.89, 32.40, 32.39 and 28.95 percent and for Others the share in these corresponding occupations is 55.81, 43.25, 60.15, 58.86 and 57.19 percent respectively. The percentage share of ST workers in occupations of teaching professionals, office clerks, customer services clerks, personal and protective service workers, model, sales persons, and demonstrators is 4.48, 5.93, 1.76, 6.99 and 4.24 percent and the percentage share of SC workers in these corresponding occupations is 10.25, 14.10, 14.14, 1.90 and 11.17 percent, share of OBC workers is 36.48, 33.83, 35.56, 58.63 and 42.82 percent and these figures for Others are 48.79, 46.13, 48.55, 32.48, 41.78 percent respectively.

If we look at market-oriented skilled agricultural and fishery workers the proportional share of OBC workers (45.54 percent) is higher, followed by Others (26.05 percent), ST workers (16.24 percent) and SC (12.16 percent) respectively, these market-oriented skilled agriculture covers market gardeners, crop growers, market-oriented animal producers, hunters and trappers. Likewise for the subsistence agricultural workers the proportional share of ST, SC, OBC and Others workers is 4.30, 19.62, 68.30 and 7.78 percent. Moreover the proportional share of ST, SC, OBC and Others workers in extraction and building trader workers is 8.12, 28.58, 44.18 and 19.13 percent. Furthermore, the proportional share of ST workers in various occupations like other crafts and related trades workers, stationary plant and related operators, machine operators and assemblers, drivers and mobile plant operators, sales and service, elementary occupations, agricultural, fishery and related labourers and mining, construction, manufacturing and transport is 2.92, 3.72, 2.79, 4.06, 5.04, 14.44, and 11.96 percent. The corresponding figures for SC workers are 17.37, 21.19, 12.86, 18.85, 30.27, 31.27 and 33.75 percent, proportional share of OBC workers in these occupations is 49.90, 38.46, 45.07, 47.33, 40.68, 40.93 and 38.77 percent. In comparison, the percentage share of Others in these corresponding occupations is 29.81, 36.63, 39.28, 29.77, 24.01, 13.36 and 15.52 percent respectively.

It is indicated that the STs, SCs and OBCs have a large proportion of their workforce in the lowest paid type of casual employment that are concentrated largely in agriculture and construction. Therefore, the lower caste people are mainly crowded in the occupations that are least paid and exploits their labour power like construction, mining and quarrying, sewerage, street vendors, shoe cleaning, cleaners, launderers, building caretakers, door keepers, garbage collectors and related activities. The lower caste workers are also observed to be over-represented in the least security and high health risk occupations like metal processing, chemical processing, glass and ceramic operators, power production, etc.

Poverty among Workers Based on Caste

There is general agreement in India on the norms being scalars called poverty lines (PL) for the society as a whole and/or for well-defined socio-economic groups within the society as well as their stability in real terms. The poverty lines are defined as the value at well-defined and specified prices in some base year of specified bundles or baskets and are called Poverty Line baskets (Srinivasan, 2011). The poverty estimation in this study is based on the Expert Group methodology of Tendulkar Committee. The national poverty line for the year 2011-12, for rural areas using the Tendulkar methodology, is estimated at ₹816 per capita per month and ₹1,000 per capita per month in urban areas.

For canvassing household expenditure on a recall basis, the NSSO shifted to Mixed Reference Period (MRP) for all its consumption surveys in future, namely, 365 days for low-frequency items (clothing, footwear, durables, education and institutional health expenditure) and 30-days for all the remaining items. This change captures the household consumption expenditure of the poor households on low-frequency items of purchase more statisfactorily than the earlier 30-day recall period. This Expert Group decided to adopt the MRP based estimates of consumption expenditure as the basis for future poverty lines as against the previous practice of using Uniform reference period estimates of consumption expenditure (Planning Commission, 2009).

On the basis of Monthly per capita consumption Expenditure, the percentage of workers living below poverty line among different social groups is explored in Table 5. The data depicts the high proportion of poor among ST workers, as 48.86 percent of the rural and 28.32 percent of the urban ST workers were below the poverty line in 2011-12 followed by the SC workers. It is estimated that 33.41 percent of the rural and 23.48 percent of urban SC workers were below the poverty line. Furthermore, the rural poverty among OBC workers is 25.62 percent and the urban poverty among the same group is 17.24 percent. In contrast, the analysis examines that the poverty among 'Others' is lower, as 17.38 percent rural and 9.07 urban workers are below poverty line among these higher caste groups. Thus the lower caste workers continue to suffer from social and economic exclusion in India and occupational disadvantages in all the sectors and economic activities. The study also scrutinize that higher proportion of poor belongs to rural and backward regions.

CONCLUSIONS

The workers are, therefore, differentiated on the basis of traditional and hierarchal identities of caste and gender at the workplace even in the contemporary labour market. Females in the masculine dominated families are illusioned as weaker section of the society; hence, they are mainly preferred to perform the domestic duties considered as the least value adding occupation by the social and economic indicators. The Indian labour-surplus economy is characterized with the persistence of dual labour market, as one labour market for the poor and another for the better-off. Indian labour market also tends to be segregated on the basis of gender as female labour market and the male labour market. The females are mainly preferred for lower paid works that has limited upward mobility. As social disadvantaged groups have limited choices in occupations, therefore these barriers squeeze them to work in low security and high health risk jobs that makes them to earn either less than or equal to their subsistence level. This will increase their ability and efficiency to work and compete in the stiff labour market. Individuals with same productivity and capability are thus discriminated in labour a market due to unequal treatment of the workers on the basis of caste, gender, race, colour,and dynasty, etc. Technological change, training, and recruitment all affect labour costs and the composition of employment, thus play a large role in the process of labour force adjustment to structural change. Differential access to education and training facilities for lower castes and females acts as the major constraints and effectively reduces the opportunity for these disadvantaged groups to gain access to social services, limits their participation in the labour market and lock people into long-term constraints and poor economic conditions. Therefore, across the social groups, the incidence of poverty has been pronounced among the SCs and Sts.

REFERENCES

Ambedkar, B.R. (1936). *Annihilation of caste.* New Delhi: Navayana Publishing Pvt Ltd.

Becker, G.S. (1985). Human capital, effort, and the sexual division of labour. *Journal of Labour Economics, 3*(1), S33-S58.

Corak, M. (2013). Income Inequality, equality of opportunity, and intergenerational mobility. *Journal of Economic Perspectives*, *27*(3), 79-102.

Cortese, C.F., Falk, F., & Cohen, J.K. (1976). Further considerations on the methodological analysis of segregation indices. *American Sociological Review, 41*, 630-637.

Deaton, A. (2008). Price trends in India and their implications for measuring poverty. *Economic and Political Weekly, 43,* 43-49.

Duncan, O.D. (1969). Inheritance of poverty or inheritance of race? In D.P Moynihan (Ed.) *On understanding poverty* (Chapter 4, 85-110). New York and London: Basic Books. .

Duncan, O.D., & Duncan, B. (1955). A methodological analysis of segregation indexes. *American Sociological Review*, *20*(2), 210-217.

Edgeworth, F.Y. (1922). Equal pay to men and women for equal work. *The Economic Journal, 32*(128), 431-457.

Hartmann, H. (1976). Capitalism, patriarchy, and job segregation by sex. *Signs, Women in Culture and Society, 1*(3), 137-139.

Jaiswal, S. (1998). *Caste, origin, function, and dimensions of change.* New Delhi: Manohar Publishers and distributors.

James, D., & Taeuber, K. (1985). Measures of segregation. *Sociological Methodology, 15*, 1-32.

Narula, S., & Macwan, M. (2001). Untouchability: The economic exclusion of the Dalits in India. International Council on Human Rights. Policy Working Papers.

Planning Commission. (2009). *Report of the expert group to review the methodology for estimation of poverty.* Planning Commission, New Delhi.

Sakoda, J.M. (1981). A generalized index of dissimilarity. *Demography, 18*(2), 245-250.

Siltanen, J. (1990). Social change and the measurement of occupational segregation by sex: An assessment of the sex ratio index. *Work, Employment, and Society, 4*(1), 1-29.

Srinivasan, T.N. (2013). Planning, poverty and political economy of reforms: A tribute to Suresh Tendulkar. *Indian Economic Review*, *Special Issue: Perspectives on Economic Development and Policy*. *48*(1), 1-32.

Thorat, S., & Newman, K.S. (2007). Caste and economic discrimination: Causes, consequences, and remedies. *Economic and Political Weekly, 42*(41), 4121-4124.

Watts, M. (1992). How should occupational sex segregation be measured? *Work, Employment and Society, 6*(3), 475-487.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 486-490
DOI: 10.5958/2322-0430.2018.00101.4

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Entrepreneurial Behavior of the Agro-Processing Complex Owners, Trained by Punjab Agricultural University, Ludhiana

Priyanka Sharma[1] and Ravinder Kaur Dhaliwal[2]*

[1]*Research Scholar, and* [2]*Professor, Department of Extension Education, Punjab Agricultural University, Ludhiana-141004*

[*]*Corresponding author's email: p.sharma14pau21@gmail.com*

Received: December 29, 2017 *Manuscript Number: NS-18-46* *Revision Accepted: February 28, 2018*

ABSTRACT

Agro-processing complexes play a vital role in overall economic development of the farmers. In this paper, attempt has been made to examine the "Entrepreneurial behavior of the agripreneurs of Punjab", who had established agro-processing complexes after getting trained from PAU, Ludhiana. The findings revealed that 68 percent of the agripreneurs had risk-taking ability from medium to high. A little less than (47.15 percent) agripreneurs had high hope of success. More than 90 percent of the agripreneurs had medium to high innovativeness. More than half (55.73percent) of the agripreneurs had medium overall entrepreneurial behavior. Land owned, income and mass media exposure of the agripreneurs had positive and significant relationship with entrepreneurial behavior of the agripreneurs at one percent level of significance.

Keywords

Agripreneurs, entrepreneurial behavior, innovativeness, socio-economic characteristics.

JEL Codes

P36, P46, Q16.

INTRODUCTION

Agro-processing industries play a key role in rural development providing food, shelter, and clothing, generating employment and income and contributing to overall economic growth. Agro-processing industry can become an anchor activity for integrated rural development and can form the basis for environmentally sustainable rural development. Agro-processing not only stimulates value addition but also generates, direct and indirect employment, particularly in rural areas of the country to absorb the surplus workforce.

Agripreneurs can be defined as the entrepreneurs combining their love of farming and agriculture with business. Punjab Agricultural University is playing a vital role in the establishment of agro-processing units in the state. Keeping in view the significance of agro-processing complexes in the state, PAU is imparting training and providing technical guidance and support to the rural population for the establishment of the agro-processing complexes since 2001. Per year, two trainings are organized. Approximately 450 farmers were trained from 2001 to 2015.

Till date, more than 236 agro-processing complexes have been established across Punjab state under the guidance of the Department of Processing and Food Engineering, PAU, Ludhiana. It was necessary to know about the agripreneurial behavior of the agripreneurs and no study has been conducted for this purpose. Therefore, the present study was done to depict the entrepreneurial behavior of the agripreneurs.

MATERIAL AND METHODS

A list of agro-processing complexes established by Punjab Agricultural University was procured from Head, Department of Processing and Food Engineering, PAU, Ludhiana. Out of the list of the 250 respondents, a total of 70 agripreneurs were selected randomly. The spread of the sample was in the districts of Bathinda, Ludhiana, Moga, and Faridkot. The variable under the study is 'entrepreneurial behavior' of the agripreneurs which has been operationalized as the extent to which agripreneurs have the traits responsible for the entrepreneurial behavior. Entrepreneurial behavior was measured by self-assessment scale with minor modifications (Techno Net Asia, 1981). These traits are considered specific

parameters for measuring the entrepreneurial behavior of agripreneurs. Ten psychological parameters for measuring the measuring the entrepreneurial behavior were:

1. Risk-taking
2. Hope of success
3. Persuability
4. Manageability
5. Knowledgeability
6. Self-confidence
7. Persistence
8. Use of feedback
9. Innovativeness
10. Achievement motivation

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Agripreneurers

Socio-economic characteristics are the measure of individual and individual's family's social and economic position. The information pertaining to the socio-economic characteristics of the agripreneurers is placed in Table 1.

Age

The age of the respondents was classified into three categories by using cumulative cube root method and these were young, middle and old as given in Table 1. It ranged between 24-60 years. Majority of the respondents were in the middle age group (44.28 percent) while 40 percent were in young age group and 15.71 percent of the respondents fell in old age group.

Education

The education of the respondents was categorized into five categories as presented in Table 1. It is clear from the Table 1 that 35.71 percent were matriculate, 25.71 and 21.42 percent of the respondents were middle and graduates respectively. While 14.28 percent respondents have studied up to primary level and two were post-graduates.

Family type

It is apparent from the Table 1 that 64.28 percent of the agripreneurs hailed from nuclear families and 35.71 percent of the agripreneurs belonged to joint families.

Family Size

Regarding the size of the family, 50 percent of the respondents belonged to the small family of one to five members 31.42 percent belonged to the medium family with five to nine members. Only 10 percent of the

Table 1. Distribution of respondents according to socio-economic characteristics of the agripreneurs

(n=70)

Parameters		Number	Percent
Age (years)	Young (20-30)	20	28.57
	Middle (30-44)	35	50
	Old (44-65)	15	21.42
Education	Primary	10	14.28
	Middle	18	25.71
	Matric	25	35.71
	Graduate	15	21.42
	Post- graduate	2	2.85
Family type	Nuclear	45	64.28
	Joint	25	35.71
Family size (No.)	Small (1-5)	41	58.57
	Medium (5-9)	22	31.42
	Large (above 9)	7	10
Operational land holding (acres)	Marginal (0-2.5)	9	21.42
	Small (2.5-5)	22	31.42
	Medium (5-12.5)	33	40
	Large (> 12.5)	5	7.1
Income (₹ lakhs/ annum)	Low (< 5 lakhs)	20	28.57
	Medium (5- 15 lakhs)	28	40
	High (> 15 lakhs)	22	31.42
Source of information about APU's	Friends	18	25.71
	Kisan Mela (PAU)	17	24.28
	Relatives	30	42.85
	Literature	5	7
Mass-media exposure	Less (9-15)	34	48.57
	Medium (15-21)	23	32.85
	High (21-27)	13	18.57

respondents belong to large family of nine and above members.

Operational landholding

Operational land holding of the respondents was categorized into five categories as mentioned in the Statistical Abstract of Punjab. As many as 34.28 percent of the respondents were small farmers having 2.5- 5.0 acres and 22.85 percent semi-medium farmers having 5-10 acres whereas 21.42 percent and 11 percent farmers were marginal and medium respectively. Only 4 respondents had more than 25 acres.

Source of information about agro-processing complexes

Majority of agripreneurs (42.85 percent) got information about agro-processing complexes from their relatives, 25.71 from their friends whereas 24.28 percent agripreneurs got information from KisanMela organized by PAU. Only seven percent agripreneurs got information about agro-processing complexes from literature.

Income from the agro-processing complex

The respondents through range method were divided into three income categories, that is, low (less than ₹5 lakhs), medium from₹5 to ₹15 lakhs and high above ₹15 lakhs. As high as 40 percent of the respondents hailed in medium category, 28.57 percent belong to low category and 31.42 percent belongs to high-income group.

Mass media exposure

It is evident from the Table 1 that majority of agripreneurs (48.57 percent) were having less mass media exposure, 32.85 percent have medium mass media exposure and only 18.57 percent agripreneurs were having high mass media exposure.

Attributes of Entrepreneurial Behaviour of Agripreneurs

Risk taking: It is apparent from Table 2 that majority of agripreneurs (50 percent) have medium risk-taking

Table 2. Distribution of agripreneurs according to their entrepreneurial behavior

(N=70)

Attributes	Categories	Number	Percent
Risk taking	Low (<5.40)	22	31.42
	Medium (5.40-8.50)	35	50
	High (>8.50)	13	18.57
Hope of success	Low (<6.12)	9	12.85
	Medium (6.12-8.71)	28	40
	High (>8.71)	33	47.14
Persuability	Low (<5.20)	4	5.71
	Medium (5.20-8.80)	39	55.71
	High (>8.80)	26	37.14
Manageability	Low (<6.52)	5	7.14
	Medium (6.52-8.95)	22	31.42
	High (>8.95)	43	61.42
Knowledgeability	Low (<6.15)	10	14.28
	Medium (6.15-8.72)	37	52.85
	High (>8.72)	23	32.85
Self-confidence	Low (<5.25)	14	20
	Medium (5.25-8.80)	32	45.71
	High (>8.80)	24	34.28
Persistence	Low (<5.64))	4	5.71
	Medium (5.64-8.89)	35	50
	High (>8.89)	31	44.28
Use of feedback	Low (<5.52)	2	2.85
	Medium (5.52- 8.91)	35	50
	High (>8.91)	33	47.14
Innovativeness	Low (<5.68)	3	4.28
	Medium (5.68-8.67)	42	60
	High (>8.67)	25	35.71
Achievement motivation	Low (<6.86	4	11.42
	Medium (6.86-8.87)	34	48.57
	High (>8.87)	32	45.71

ability, 31.42 percent agripreneurs have low risk taking ability whereas only 18.57 percent agripreneurs have high risk-taking ability. This might be due to the difference in income, operational landholding, and other assets of the agripreneurs.

Hope of success: This attribute is the degree to which an individual is prepared to face the consequences of his venture. It is evident from the Table 2 that majority of the entrepreneurs (47.14 percent) had high level of this trait followed by the medium (40 percent) and low (12.85 percent) level of this attribute. More likely interpretation of the results indicate that high (87.14 percent) of the entrepreneurs are supposed to get moderate to high success, whereas 12.85 percent entrepreneurs had low chances to succeed.

Persuability: The medium level of this trait was possessed by (55.71 percent) of entrepreneurs followed by high (37.14 percent) level of this attribute whereas 5.71 percent of the entrepreneurs possess low level of persuability. It can be found that entrepreneurs can effectively convince others about their own idea (Table 2).

Manageability: It is apparent from the data in Table 2 that 61.42 percent agripreneurs have high manageability, 31.42 percent possesses medium and 7.14 have low manageability.

Knowledgeability: It is evident from the Table 2 that majority (52.85percent) of agripreneurs have medium knowledgeability attribute, 32.85 percent of the agripreneurs possesses high knowledgeability and 14.28percent of the agripreneurs possesses low level of this attribute.

Self-confidence: The possession of this attribute explains the degree to which an individual expresses confidence in his availability to complete a task or meet a challenge. A close examination of Table 2 depicts that majority (45.71 percent) of the agripreneurs have medium level of self-confidence, 34.28 percent agripreneurs possesses high level of self-confidence whereas 20 percent of the agripreneurs possess low level of self-confidence.

Persistence: By knowing the level of this attribute possessed by an individual, the extent up to which he can try different options to overcome obstacles can be predicted. It was observed that 50 percent of the agripreneurs perceived themselves under medium level of persistence while 44.28 percent of them under high level of persistence whereas only 5.71 percent of the agripreneurs perceive themselves under low level of persistence.

Feedback usage: It is ability to seek and use feedback on the ones performance and decisions and is an important quality of entrepreneurs. A glance at Table 2 presents that 50 percent of the agripreneurs possess medium level of feedback usage, 47.14 percent of the agripreneurs possesses high level of feedback usage whereas only 2.85 percent agripreneurs possess low use of feedback.

Innovativeness: it refers to the extent to which a agripreneur perceives himself to act in a way so he can extend his enterprise by acquiring new technology, products,and services. Data in the Table 2 indicates that 60 percent of the agripreneurs possesses medium level of innovativeness, 4.28 percent agripreneurs have low level of innovativeness followed by 35.71 percent agripreneurs having high level of innovativeness.

Achievement Motivation: It is an urge to improve oneself and excel in relation to a goal and many empirical evidences proved it as an integral part of the entrepreneurship. It is apparent from the data in Table 2 that majority of the agripreneurs (48.57 percent) possesses medium level of achievement motivation, 45.71 percent of the agripreneurs possesses high level of achievement motivation and only 5.71 percent of the

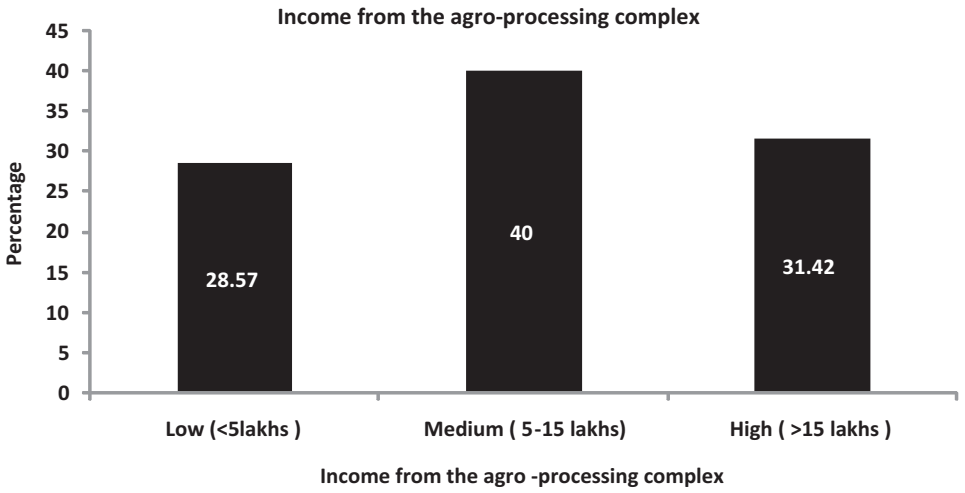


Figure. 1. Distribution of the respondents according to income from the agro-processing complexes

Table 3. Distribution of respondents according to overall entrepreneurial behavior

(N=70)

Categories	Number	Percent
Low (<6.14)	8	11.42
Medium (6.14-9.48)	39	55.71
High (>9.48)	23	32.85

Table 4. Relationship of entrepreneurial behavior with different socio-economic characteristics

Socio-economic characteristics	Correlation coefficient
Land owned	0.354**
Income	0.718**
Age	0.030NS
Family size	-0.231 NS
Mass media exposure	0.214**

*****Significant at 5 percent level.***
NS; Non-significant.

agripreneurs possesses low level of achievement motivation.

Overall Entrepreneurial Behaviour of Respondents

The score obtained by an individual on all ten attributes of entrepreneurial behavior was pooled and referred to a score of entrepreneurial behavior for that individual. The data in concern with overall entrepreneurial behavior was worked out and have been presented in Table 3. It was found that more than half (50 percent) of the agripreneurs have medium level of entrepreneurial behavior, 32.85 percent agripreneurs have high level of entrepreneurial behavior followed by 11.42 percent having low level of entrepreneurial behavior. Findings are in conformity with those of Singh (2016).

Land owned income of the agripreneurs and mass media exposure of the agripreneur is positively and significantly correlated with entrepreneurial behavior of the agripreneurs. More will be the land owned, income and mass media exposure of the agripreneur more will be the entrepreneurial behavior of the agripreneurs. Age has no effect on the entrepreneurial behavior of the agripreneurs whereas family size is having negative and non-significant effect on entrepreneurial behavior of the agripreneurs. More will be the family size low will be the entrepreneurial behavior of the agripreneur.

CONCLUSIONS

It can be concluded from the findings that most of the agripreneurs have medium to high entrepreneurial behavior. Most of them were possessing medium risk-taking, persuability, knowledgeability, self- confidence, persistence, use of feedback and innovativeness attributes. More than half of them were having high hope of success and high manageability. Agripreneurs entrepreneurial behavior was found to be positively and significantly correlated with land owned, income and mass media exposure whereas age of the agripreneur had non- significant relation with entrepreneurial behavior of the agripreneurs.

REFERENCES

Techno-Net Asia. (1981). *Entrepreneurs handbook institute for small-scale industries* (library 338 93 (021)/TEC/84/21477). Singapore: NISIET.

Singh, P. (2016). *A study on the entrepreneurial behavior of the dairy farmers in Punjab* (Master's Thesis). Punjab Agricultural University, Ludhiana, Punjab.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 491-496
DOI: 10.5958/2322-0430.2018.00102.6

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Opinion of Teachers towards Quality Assurance in Higher Agricultural Education

Ritu Shah[1] and Gyanendra Sharma[2]*

[1]*Ph.D. Scholar, Dept. of Extension Education, BHU* [2]*Professor, Department of Agricultural Communication GBPUAT, Pantnagar-263153 (Uttarakhand)*

[*]*Corresponding author's email: ritushah13dec@gmail.com*

Received: December 03, 2017 *Manuscript Number: NS-18-56* *Revision Accepted: February 13, 2018*

ABSTRACT

The quality education is not only challenging but also of paramount importance in today's globalized world. In the continued process of quality assurance in higher Agricultural Education, the ICAR established an Accreditation Board during 1996 with well-defined objectives and functions. Report of the 4th Deans Committee has also highlighted measures to improve the quality of Agricultural Education. ICAR has given emphasis on quality assurance in higher agricultural education. In this background, this study was conducted to analyze teachers' opinion on different parameters of quality assurance. The study was conducted in Govind Ballabh Pant University of Agriculture and Technology, Pantnagar. Out of seven colleges, College of Agriculture was selected. Teachers were selected as a respondent. The descriptive research design was used. The findings of the study revealed that the majority of the respondents were satisfied with the different quality assurance measures. Main suggested measures for improving the quality of instruction were use of multimedia for teaching, smart classrooms for effective teaching, uniform delivery of content to all sections of UG course, regular feedback from students, regular monitoring of classroom instruction, etc.

Keywords
Higher agricultural education, ICAR, quality assurance, teachers.

JEL Codes
A29, C81, I23, I28.

INTRODUCTION

Higher education is the backbone of any society. It is the quality of higher education that decides the quality of human resources in a country. By 2025, the projected global demand for higher education could reach 263 million students, which is an increase from a little less than 100 million students in 2000. This could represent an increase of 163 million students in 25 years (Karaim, 2011). As the demand for quality education increases, there is a growing demand for quality assurance (QA) for international universities where there is increased mobility of students, faculty, programs, and higher education institutions in global networks (Hou, 2012; Varonism, 2014). Quality assurance in higher education is defined as the totality of the system, resources, and information devoted for maintaining and improving the quality and standards of teaching, learning, and research. India has one of the largest higher education systems in the world. State government plays the main role in the higher education system in the country. The University Grants Commission (UGC) serves as a link between the union and state governments and institutions of higher learning. There are several regulatory bodies like Ministry of Human Resource Development, ICAR, and UGC, etc. which regularly monitor the quality of education. The University Grants Commission (UGC) with its statutory powers is expected to maintain quality in Indian Higher education institutions.

India achieved remarkable growth in food grains production, which is unprecedented and admired the world over. The cradle of this success has been the establishment of institutions of higher agricultural education which developed skilled human resource. Department of Agricultural Research and Education

(DARE) and Indian Council of Agricultural Research (ICAR) have the mandate of regulating higher agricultural education in the country. In addition, ICAR (2012) has put in motion a number of initiatives and reforms to assure the quality in agricultural education which include establishment of Educational Panel (1952), Standing Committee on Agricultural Education (1965), Norms and Accreditation committee (1974), Accreditation Board for Quality Assurance (1996), faculty competence improvement through training, library strengthening, institution of scholarships and fellowships, measures for reducing inbreeding, infrastructure support for library, hostels and procurement of state of the art equipment etc. to have quality assurance in agricultural education. The report of the 4th and 5th Deans Committee has to advocated the need to give attention to reorient Agricultural Education. There are several factors affecting quality of education and need urgent attention. Quality assurance in higher agricultural education has been given emphasis by the higher bodies like ICAR. The National Assessment and Accreditation Council (NAAC, 2006) provide guidelines to ensure quality of education except the routine rituals of monitoring implementation of education. There are very few studies conducted in India as it is very important aspect to be considered. Thus, the quality assurance in agricultural education as expressed by faculty needs to be probed. Keeping these points in mind this study was undertaken with the main objective to analyze quality assurance in agriculture education based on the opinion of teachers.

METHODOLOGY

G.B. Pant University of Agriculture and Technology, Pantnagar was selected purposively as a locale of the study as it's a first State Agricultural University of India in Udham Singh Nagar district of Uttarakhand state. Established on the recommendation of University Education Commission (1948) headed by Dr. Radhakrishnan, this university was the first rural university. The university has seven constituent colleges viz. College of Agriculture, College of Home Science, College of Veterinary & Animal Sciences, College of Basic Science and Humanities, College of Technology, College of Agri-Business Management and College of Fisheries. Then out of seven Colleges, College of Agriculture was selected purposively for the study. College of Agriculture established in 1960 is one of the first colleges of the university. This college has largest number of faculty members. The establishment of this college was an important milestone for the development of the first agricultural university. As teachers are responsible for 'quality' in teaching so were selected as respondents. Descriptive research design was used for conducting this research study. Status of quality assurance of the university was assessed on six parameters i.e. lecture halls, smart classroom, computer, and internet facility, laboratory facilities, library facilities, and curriculum.

RESULTS AND DISCUSSION

Socio Personal Profile

The Majority of the respondents (60.00 percent) belonged to middle age group followed by 22.00 percent who belonged to old age category and only 11.00 percent belonged to young age category. Majority of the respondents (92.00 percent) were males and only (8.00 percent) were females. Half of the respondents (50.00 percent) were professor and equivalent followed by 38.00 percent who were assistant professor and equivalent and rest (12.00 percent) were associate professor and equivalent. Total number of the respondents possessed Ph.D. as their educational qualification. Majority of the respondents (80.00 percent) have medium teaching experience followed by 16.00 percent of those who have high teaching experience and 4.00 percent have low teaching experience. Half of the respondents (50.00 percent) have administrative responsibility while rest 50.00 percent did not have any administrative responsibility. Majority of the respondents (56.00 percent) had received training in teaching skills followed by 44.00 percent who had not received training in teaching skills. Majority of the respondents (74.00 percent) have medium job satisfaction followed by 14.00 percent of those who have low job satisfaction and 12.00 percent have high job satisfaction. The similar results were reported by Tyagi (1993).

Opinion of Teachers towards Quality Assurance Measures

The Opinion of teacher was sought on various parameters of quality assurance with respect to agricultural education. The parameters are lecture halls, smart classroom, computer & internet facility, laboratory facilities, library facilities,and curriculum. The results obtained on each of these parameters have been discussed below:

Lecture Halls

In this study, it refers to the adequacy of the lecture halls, furniture, and quality of blackboards/whiteboards, electricity facility, cleanliness, technology integration, audiovisual and multimedia supports in the lecture halls.

More than half of the respondents (64.00 percent) were satisfied with adequacy of the lecture halls followed by 30.00 percent of the respondents who were not satisfied. The respondents' opinion was that the entire lecture hall set up needs improvement. Lecture halls need to be renovated and given a shape of lecture theatre. It requires monitoring by Head of the Department (HOD) and Dean of the college. Data regarding furniture shows that majority of respondents (62.00 percent) were satisfied with the available furniture followed by 6.00 percent respondents who were highly satisfied. Some respondents had opinion that it has poor maintenance and requires bitupgradation**.** Few were not satisfied because sometimes shortage of the furniture was observed and there was very old furniture. A perusal of the data

regarding quality of blackboard or whiteboard shows that maximum numbers of the respondents (50.00 percent) were satisfied followed by 46.00 percent respondents who were not satisfied. Respondents belonging to both the categories of respondents were of the opinion that the classrooms need to be renovated and given a 'Theatre shaped' lecture hall. Lecture halls need to be upgraded and equipped with the multimedia equipment. Majority of the respondents (70.00 percent) were satisfied with electricity facilities in the lecture halls followed by 18.00 percent respondents who were not satisfied. Only 12.00 percent respondents were highly satisfied. Data regarding cleanliness shows that majority of the respondents (54.00 percent) were not satisfied with the cleanliness in the lecture halls followed by 42.00 percent respondents who were satisfied. Only 4.00 percent respondents were highly satisfied. Data regarding technology integration reveals that majority of the respondents (58.00 percent) were not satisfied with the technology integration in the lecture halls followed by 38.00 percent respondents who were satisfied. Only 4.00 percent respondents were highly satisfied. Majority were not satisfied because there was very poor technology integration. Majority of the respondents (76.00 percent) were not satisfied with the audiovisual and multimedia support in the lecture halls followed by 22.00 percent respondents who were satisfied. Only 2.00 percent respondents were highly satisfied. More than 50.00 percent respondents were not satisfied. This is due to non-availability of audio-visual aids in the classrooms.

Table 1. Socio-personal profile of the respondents

Variable	Categories	Frequency	Percentage
Age (years)	Young (less than 40)	9	18
	Middle (40-57)	30	60
	Old (more than 57)	11	22
Gender	Male	46	92
	Female	4	8
Designation	Assistant Professor and equivalent	19	38
	Associate Professor and equivalent	6	12
	Professor and equivalent	25	50
Educational qualification	Post-doctoral	-	-
	Ph.D.	50	100
	M.Sc.	-	-
Teaching	Low (less than 8 years)	2	4
	Medium(8-28 years)	40	80
	High(more than 28 years)	8	16
Administrative responsibility	Yes	25	50
	No	25	50
Training received in teaching skills	Yes	28	56
	No	22	44
Job satisfaction	Low (less than 67)	7	14
	Medium (67-77)	37	74
	High (more than 77)	6	12

Table 2. Opinion of teachers' towards lecture halls

(N=50, percent)

Category	Highly satisfied	Satisfied	Not satisfied
Adequacy of the lecture halls	6.00	64.00	30.00
Furniture	6.00	62.00	32.00
Quality of blackboard or whiteboard	4.00	50.00	46.00
Electricity facility	12.00	70.00	18.00
Cleanliness	4.00	42.00	54.00
Technology integration	4.00	38.00	58.00
Audio- visual and Multimedia support	2.00	22.00	76.00

Table 3. Opinion of teachers' towards smart classroom

(N=50, percent)

Category	Highly satisfied	Satisfied	Not satisfied
Accessibility	4.00	40.00	56.00
Quality	6.00	46.00	48.00

Table 4. Opinion of teachers' towards computer and internet facility

(N=50, percent)

Category	Highly satisfied	Satisfied	Not satisfied
Central computing facility (CCF)	12.00	68.00	20.00
Internet accessibility	4.00	56.00	40.00

Smart classroom

Smart classrooms were constructed in various colleges of the university to improve quality of instruction. Opinion of the teachers was sought with respect to the accessibility of this facility to teachers. Accessibility refers to the availability of smart classroom facility to teachers.

Data regarding accessibility of smart classroom shows that majority of the respondents (56.00 percent) were not satisfied with the accessibility of smart classroom followed by 40.00 percent respondents who were satisfied. Only 4.00 percent were highly satisfied with this facility. More than50.00 percent respondents were not satisfied because it is a time taking process to take permission. It is accessible only on request. Maximum numbers of the respondents (48.00 percent) were not satisfied with the quality of smart classrooms followed by 46.00 percent respondents who were satisfied. Only 6.00 percent respondents were highly satisfied.

Computer and internet facility

Teachers' opinion was sought on services of Central Computing facility (CCF) providing computer and internet support to students and teachers.

Data regarding CCF shows that majority of the respondents (68.00 percent) were satisfied with the Central Computing Facility followed by 20.00 percent respondents who were not satisfied. 12.00 percent were highly satisfied with this facility. Data regarding accessibility to computer and internet facility shows that majority of the respondents (56.00 percent)were satisfied with the accessibility to computer and internet facility followed by 40.00percent respondents who were not satisfied. Only 4.00 percent respondents were highly satisfied.

Laboratory facilities

It refers to the infrastructure, equipment availability, and equipment maintenance and field practical facility.

Data regarding infrastructure of the laboratories shows that majority of the respondents (68.00 percent) were satisfied with the infrastructure of the laboratories followed by 20.00 percent respondents who were not satisfied. Only 12.00 percent respondents were highly satisfied. Some respondents added that infrastructure for laboratories are not sufficient. Data regarding equipment availability in the laboratories have been presented in not satisfied with equipment available in the laboratories followed by 44.00 percent respondents who were satisfied. Only 10.00 percent respondents were highly

Table 5. Opinion of teachers' towards laboratory facilities

(N=50, percent)

Category	Highly satisfied	Satisfied	Not satisfied
Infrastructure	12.00	68.00	20.00
Equipment availability	10.00	44.00	46.00
Equipment maintenance	4.00	126.00	70.00
Field practical facility	120.00	58.00	22.00

Table 6. Opinion of teachers' towards library facilities

(N=50, percent)

Category	Highly satisfied	Satisfied	Not satisfied
Availability of books	22.00	70.00	8.00
Availability of journals	16.00	50.00	34.00
Issuing process	18.00	78.00	4.00
Upgradation of books, journals, magazine etc.	4.00	68.00	28.00
Electronic arrangement	6.00	76.00	18.00
Documentation section facility	10.00	74.00	16.00

satisfied. A perusal of the data shows that majority of the respondents (70.00 percent) were not satisfied with equipment maintenance in the laboratories followed by 26.00 percent respondents who were satisfied. Only 4.00 percent respondents were highly satisfied. Majority of the respondents were not satisfied as according to them no fund is provided by university or college for the maintenance. Data regarding field practical facility shows that majority of the respondents (58.00 percent) were satisfied with field practical facility followed by 22.00 percent respondents were not satisfied and 20.00percent respondents were highly satisfied.

Library facilities

It refers to availability of books and journals (e-journal and hard copy), issuing process, upgradation of the books, journals, magazine etc., electronic arrangements and documentation section facility.

Data regarding the availability of books shows that majority of the respondents (70.00 percent) were satisfied with the books' availability followed by 22.00 percent respondents who were highly satisfied. Only8.00 percent respondents were not satisfied. Data regarding the availability of journals shows that majority of the respondents (50.00 percent) were satisfied with the journals availability followed by 34.00 percent respondents who were not satisfied and 16.00 percent respondents were highly satisfied. The reason for satisfaction could be that the university library has a large collection of journals in various disciplines. Some of the respondents were highly satisfied which might be due to the fact that the regular and updated journals are available. Subscription of new journals should be done. Some opined that journals should be available in all the disciplines like there were very few journals of food sciences. A cursory look on the data shows that majority of the respondents(78.00 percent) were satisfied with the issuing process followed by 18.00 percent respondents who were highly satisfied and 4.00 percent respondents were not satisfied. Data regarding upgradation of books, journals, magazine etc. reveals that majority of the respondents (68.00 percent) were satisfied followed by 28.00 percent respondents who were not satisfied and only 4.00 percent respondents were highly satisfied. Data regarding electronic arrangement indicates that majority of the respondents (76.00 percent) were satisfied with the electronic arrangement followed by18.00 percent respondents who were not satisfied. Only 6.00 percent respondents were highly satisfied. Data regarding documentation section facility show that majority of the respondents (74.00 percent) were satisfied with the documentation section facility followed by 16.00 percent respondents who were not satisfied. Only 10.00 percent respondents were highly satisfied.

Curriculum

It refers to the syllabus, examination pattern and evaluation procedure of the university. Data regarding syllabus shows that majority of the respondents (70.00 percent) were satisfied with the syllabus followed by 20.00 percent respondents who were highly satisfied. Only 10.00 percent respondents were not satisfied. Respondents have expressed that the syllabus needs to be revised. Data regarding examination pattern reveals that majority of the respondents (62.00 percent) were satisfied with the examination pattern followed by 20.00 percent respondents who were highly satisfied. Only 18.00 percent respondents were not satisfied. Data regarding evaluation procedure reveals that majority of the respondents (64.00 percent) were satisfied with the evaluation procedure followed by 18.00 percent respondents who were highly satisfied and 18.00 percent respondents were not satisfied.

Improvements needed in upgrading the classrooms

Teachers had different opinion regarding improvements needed in upgrading the classrooms. Majority of the teachers opined that every classroom should have the required facilities and timely availability of multimedia in working condition. Teachers opined that classrooms should be equipped with computers and

Table 7. Opinion of teachers' towards curriculum

(N=50, percent)

Category	Highly satisfied	Satisfied	Not satisfied
Syllabus	20.00	70.00	10.00
Examination pattern	20.00	62.00	18.00
Evaluation procedure	18.00	64.00	18.00

Table 8. Measures suggested for improving quality of instruction

Suggested measure	Frequency	Percentage	Ranking
Use of Multimedia for teaching	40	80.00	I
Smart classrooms for effective teaching	34	68.00	II
Uniform delivery of content to all sections of UG course	29	58.00	III
Feedback from all the students	27	54.00	IV
Regular monitoring of classroom instruction	25	50.00	V
Conversion of classrooms to theatre shape lecture halls	24	48.00	VI
Teachers' training in technology integration in teaching	22	44.00	VII
Recognition for good teachers	21	42.00	VIII

projectors with multimedia boards with internet connectivity. Teachers were concerned that there should be cleanliness in classrooms. Classrooms should have adequate and good quality furniture. Periodic whitewash and painting, provision of whiteboards with whiteboard markers and proper electricity fixtures for operating multimedia system were expressed as serious concerns affecting quality teaching.

Measures for improving quality of instruction

The opinion of teachers was sought on the measures to be adopted for improving quality of instruction. Various measures suggested by the teachers for improving quality of instruction have been presented below:

Majority of the teachers (80.00 percent) found use of Multimedia for teaching as important measure to improve the quality of instruction followed by 68.00 percent respondents who opined smart classrooms for effective teaching measure to improve the quality of instruction. Then 58.00 percent found uniform delivery of content to all sections of UG course, feedback from all the students (54.00 percent), regular monitoring of classroom instruction (50.00 percent), conversion of classrooms to theatre shape lecture halls (48.00 percent), teachers' training in technology integration in teaching (44.00 percent) and recognition for good teachers (42.00 percent) measures to improve the quality of instruction.

Suggestions for Implementing Quality Assurance Policies

Vacant positions in the departments must be filled to run academic work smoothly and efficiently. There is a need to establish Instructional Technology Unit to strengthen teaching and learning. This unit would design a calendar of teacher training workshops and organize such workshops at regular intervals throughout the year. There is a need to streamline the services of the Educational Technology cell by way of broad-basing the facility and inducting more competent faculty from various departments. This would facilitate prevention of the unnecessary deviations and fruitful utilization of funds provided by the ICAR in organizing teachers training more effectively (ICAR, 2002).

CONCLUSIONS

Higher education is the source or feeder system in all walks of life and therefore supplies the much-needed human resource in management, planning, design, teaching, and research. Quality assurance in higher agricultural education has been given emphasis by the higher bodies like ICAR. Quality assurance is the responsibility of everyone in an educational institution, though the top management sets the policies and priorities. Teacher play very prominent role in assuring the quality of an institution. They focus on services of Educational Technology for the advancement in learning of the students.

REFERENCES

Hou, A.Y.C. (2012). Mutual recognition of quality assurance decisions on higher education institutions in three regions: A lesson for Asia. *Higher Education*, *64*(6), 911-926.

ICAR. (2002). *Hands-on-training manual on self-study for accreditation of academic institutions and programs* (p. 35). New Delhi: ICAR.

ICAR. (2012). *Draft Policy on higher agricultural education*. New Delhi: ICAR.

Karaim, R. (2011). Expanding higher education. *CQ Global Researcher, 5*(22), 525-572. Retrieved from http://www.sagepub.com/

NAAC. (2006). Quality assurance in higher education an introduction (p 113). Bangalore, India: NAAC.

Tyagi, L.K. (1993). *Job satisfaction of the academic staff of college of agriculture, G.B.P.U.A.&T., Pantnagar* (Master's Thesis). G.B. Pant University of Agriculture and Technology, Pantnagar.

Varonism, E.M. (2014). Most courses are not born digital: An overview of the quality matters peer review process for online course design. *Campus-Wide Information Systems, 31*(4), 217-229. http://dx.doi.org/10.1108/CWIS-09-2013-0053.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 497-501
DOI: 10.5958/2322-0430.2018.00103.8

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Problems Faced by Farmers in Direct Seeded Rice- A Case Study

Shayar Brar, Pankaj Kumar and Prabhjot Kaur*

M.Sc. Student, Assistant Extension Specialist, and Professor of Extension Education
Department of Extension Education, Punjab Agricultural University, Ludhiana-141004.

**Corresponding author's email: shelleypankaj@gmail.com*

Received: December 31, 2017 *Manuscript Number: NS-18-74* *Revision Accepted: February 16, 2018*

ABSTRACT
The study was conducted in Dhulkot village of Sri Muktsar Sahib District of Punjab. A total of 100 farmers who were practicing (60) and who had discontinued (40) DSR in village Dhulkot were selected as respondents. An interview schedule was designed and data was collected through personal interview approach. In year 2015, the DSR cultivation was on peak in the village when 100 farmers were growing DSR on 323 hectares. Whereas, in study year 2016 the area under direct seeded rice declined to 121 hectares and number of farmers were 60. There were many reasons which cause the discontinuance of direct seeded rice like infestation of weeds, non-availability of DSR drill and germination failure. More infestation of weeds as compared to puddled rice was the main problem as 90.0 percent of respondents had faced this problem. Other problems include more expenditure on herbicides (88.33percent) and difficulty in weed management (86.67percent), Iron deficiency (83.33percent), non-availability of labour (80.0percent) for hand hoeing, difficulty in maintaining proper seed depth of seed (60.00percent), occurrence of rain at early stage of sowing (53.33percent). In addition to these, there were some other problems which were faced by relatively less number of respondents included off type plants or variety mixture in crop (20.0percent), non-availability of seed drill (13.33 percent) and non-availability of short duration varieties (6.66 percent).

Keywords
Direct seeded rice, weeds, weed management, technology.

JEL Codes
C81, O01, Q16, Q18.

INTRODUCTION

Rice is an important crop of world and more than half of the world's population consume on rice as staple food. Worldwide, rice has 161 million hectares, area with production of about 678.7 million tonnes. Asia which produces about 90 percent of world`s rice is also a major consumer of it (Kumar *et al.,* 2013). Due to green revolution in Punjab, the state became major producer for rice and wheat for Indian central pool. But due to the cultivation of rice which was originally recommended for marshy lands, there is serious threat to underground water in the state.

In Punjab conventional method of paddy cultivation consumes huge amount of labour, water, and energy. Rice requires huge quantity of water, which exploits groundwater resources. In Punjab irrigation is done by canals and tubewells. Whereas tubewells are the major source of irrigation, where groundwater is not suitable for crops, canal irrigation is done. The groundwater level has been gone up in last two decades. Punjab has near about 1.385 million tube wells, which meets the requirement of 3 million hectares of land. The cheap credit facility and high electricity subsidies in Punjab have further facilitated the use of groundwater resources. At present, groundwater level is depleting rapidly in the state and 110 out of 141 blocks have already been categorized as over-exploited or dark blocks and three other blocks are at critical stage (General Portal of Central Ground Water Board, 2014).

Various water saving technologies have been widely adopted in different regions of the world. A variety of water saving technologies have been developed and

recommended by Punjab Agricultural University, Ludhiana such as direct seeded rice, zero tillage in wheat, laser leveler and tensiometer etc. Adoption of such technologies may help alleviate pressure on groundwater and enhance the long-term sustainability of food production in this region (Kaur & Vatta 2015). But DSR cultivation is very rare among the farmers of the Punjab. Despite this, there was a village Dhulkot in Gidderbaha block in Sri Muktsar Sahib District, where adoption of DSR is there at considerable area. There was 323 hectares area under DSR where about 100 farmers were engaged in this practice during *Kharif* 2015. But they were facing some problems which were a threat for the success of this technology. Therefore, a case study was planned to study the problems faced by the farmers in direct seeding of rice in this village.

MATERIAL AND METHODS

The study was carried out in Dhulkot village of Sri Muktsar Sahib (Punjab). An inventory of the farmers practicing DSR in village Dhulkot was prepared. All the farmers who were practicing DSR at present or sometime earlier were selected as respondents for this study. In this way, a total of 100 farmers were selected. Data was collected with personal interview method while asking open-ended as well as structured questions. The collected data were analyzed with the appropriate statistical procedure and tools. Tools like percentage, mean, frequencies and range method were used for the analysis of data.

RESULTS AND DISCUSSIONS

Findings of the study are placed in four separate tables and discussed under three sub-headings:

Socio-personal characteristics of the respondents

The socio-personal characteristics of selected farmers such as age, education, family type, operational land holdings, and agricultural machinery owned, mass media exposure, extension contacts was analyzed. The information pertaining to the profile of the farmers has been given in Table 1.

Age

Age is an important characteristic of an individual as it governs the physical, psychological and behavioral development of the person. The results presented in Table 1 revealed that age of farmers varied from 22-66 years. Majority of the respondents (51.66 percent) belonged to the age group of 22-36 years followed by (21.66percent) in category of 37-51 years and remaining of the farmers (26.67 percent) fell in the age group of 52-66. These findings are in line with Singh (2016); Kaur (2015).

Education

Education was measured in terms of number of years one has completed successfully in school and college. The data presented in Table 1 pertaining to education of the respondents showed that more than 33 percent of respondents were matriculate and about more than 6 percent respondents were illiterate, about 22 percent of respondents had gained education up to primary and 20 percent of respondents were up to senior secondary, while

Table 1. Distribution of respondents according to their socio-personal characteristics

(N =60)

Socio-personal characteristics	Category	Frequency	Percentage*
Age (in years)	22-36	31	51.67
	37– 51	13	21.66
	52– 66	16	26.66
Education	Illiterate	4	6.66
	Primary (5th)	13	21.66
	Matric (10th)	20	33.33
	Senior Secondary (12th)	12	20.00
	Graduation	11	18.33
Family type	Joint	22	36.66
	Nuclear	38	63.33
Operational land holding (ha)	Semi-medium (2-5)	26	43.33
	Medium (5– 10)	24	40.00
	Large (> 10)	10	16.67
Mass media exposure	Low (18-25)	14	23.33
	Medium (25-32)	18	30.00
	High (32-39)	28	46.66
Extension contacts	Low (4-6)	26	43.33
	Medium (6-8)	24	40.00
	High (8-10)	10	16.67

18.33 percent were graduate or above. These findings are in agreement with the finding of Kaur (2007); Kaur (2015).

It can be observed from the results presented in Table 1 that 63.33 percent of respondents live in nuclear families and rest of 36.67 percent lived in joint families. So the majority of respondents belonged to the nuclear families.

Operational landholding

The respondents were categorized into three groups on basis of their operational land holding. Data presented in Table 1 showed that about 43 percent of the respondents had semi medium (2-4 hectares) operational land holdings for crop production, and about 40.00 percent of the respondents had medium (2-4 hectares) operational land holdings, more than 16 percent of the respondents had large (> 10 hectares) operational land holdings. So it was observed that most of the farmers fell in the category of semi medium land holdings (2-4 hectares). Whereas, marginal and small landholding was not reported by the selected respondents. These findings are in line with Kaur (2007); Kaur (2015).

Mass media exposure

Mass media exposure plays a significant role in the development of agricultural sector. Mass media is the backbone of agricultural extension through which agricultural universities; agricultural experts can easily disseminate the new knowledge to the farmers. Mass media exposure was studied in terms of reading farm literature, viewing television programme and listening to radio

The respondents were divided into three categories by using range method and data presented in Table 1 indicated that 46.66 percent of the respondents had high mass media exposure and 30.00 percent of respondents had medium mass media exposure. About 24 percent of respondents had low mass media exposure. These findings were in contradiction with Singh (2016).

Extension contacts

Extension contacts play a significant role in the adoption of any innovation. It not only helps the farmers to get new information but also change the mindset of the farmers towards innovation. The results presented in the Table 1 showed that most of the respondents (43.33percent) had low extension contacts. It might be due to that farmer-extension linkage was not very strong and respondents' visit to the various agricultural organizations such as PAU, Krishi Vigyan Kendra (KVKs) was not very frequent. Further, 40 percent of respondents had medium level of extension contacts and only 16.67 percent respondents had high level of extension contacts. The findings are in line with Kaur (2016); Kaur (2015).

Crops grown

The major crops grown in the village by the respondents were rice and wheat and data. In wheat crop, all of the respondents were growing HD 2967 variety and 75 percent of the respondents were growing HD 3086 variety of wheat. Whereas, in rice crop, 75.00 percent of the respondents were cultivating Pusa 44 and 23.33 percent of the respondents were growing PR 115 followed by (11.67percent) of the respondents were growing PR 114. Here one specific outcome can be observed that a handsome majority (88.33 percent) of respondents were growing Basmati and using Pusa 1121 variety.

Problems faced by farmers in DSR cultivation

As it is imperative with any practice, DSR do face a number of problems. Problems faced by respondents were studied with the help of structured as well as open-ended questions. The analyzed response is given in the Table 2. It is clear from the Table 2 that more infestation of weeds as compared to puddled rice was the main problem as 90.0 percent of them had faced this problem. Other problem which did associate with weeds were more expenditure on herbicides and difficulty in weed management which were faced by 88.33 and 86.67 percent of respondents respectively. Another problem which was encountered while practicing DSR was Iron deficiency as reported by 83.33 percent of respondents which is otherwise negligible in the case of puddled rice.

This weed management problem was so vigour that respondents that respondents did try to manage it with hand hoeing in addition to use of chemicals, but here also they faced problem of non-availability of labour (80.0 percent) for hand hoeing. Other major problem faced by respondents was difficulty in maintaining proper seed depth of seed as given by 60.00 percent respondents. If proper seed depth is not maintained then there was uneven germination of seeds. Similarly, occurrence of rain at early stage of sowing also resulted in poor germination as responded by 53.33 percent of the respondents.

In addition to these, there were some other problems which were faced by relatively less number of respondents. These problems include off type plants or variety mixture in crop (20.0 percent), non-availability of seed drill (13.33 percent) and non-availability of short duration varieties (6.66 percent). These findings are in line with Singh (2016); Kaur (2015).

Reasons for Discontinuance of Direct Seeding of Rice

There were many reasons which cause the discontinuance of direct seeded rice such as infestation of

Table 2. Distribution of respondents according to varieties of different crops grown in the village (N =60)

Crops grown	Varieties	Frequency	Percentage*
Wheat	HD 2967	60	100.00
	HD 3086	45	75.00
Rice	Pusa 44	45	75.00
	Pusa 1121	50	88.33
	PR 114	7	11.67
	PR 115	14	23.33

The percent exceeds 100 due to multiple response.

weeds, non-availability of DSR drill, etc. There were total of 40 farmers who had discontinued the DSR cultivation. It can be pointed out from the data presented in the table 15 that all the respondents given that weed infestation were the major problem in direct seeded rice and more requirements of herbicides which led them to discontinuance of the DSR cultivation. Many of the respondents (92.5percent) discontinued DSR cultivation because it requires specific seed drill machine so because they couldn`t use their existing drill, so extra cost is involved in shape of mechanization. These findings are similar to the findings reported by Kaur (2015).

Further, there was high risk reported by 87.50 percent of the respondents. This high risk was in terms of voluntary rice germination of paddy which results in admixture of varieties and secondly, there were chances of pre-monsoon rains which create *karand* conditions. Other problems of major concern were iron deficiency (87.5percent) and zinc deficiency (72.5 percent) faced by the respondents. Some of the respondents also given that there was less yield in DSR as compared to traditional method and very few (10.0 percent) respondents left this practice because they could not get DSR drill machine on time for sowing.

Table 3. Distributions of respondents according to the problems faced by them in direct seeded rice

(N=60)

Problems in direct seeded rice	Frequency	Percentage*
Non-availability of seed drill	8	13.33
Non-availability of short duration varieties	4	6.66
Difficulty in maintaining proper depth of seed	36	60.00
Land preparation	29	48.33
Incidence of rain during early stage (crust formation)	32	53.33
Iron deficiency	50	83.33
More infestation of weeds as compared to puddled rice	54	90.00
Difficulty in weed management	52	86.67
More expenditure on herbicides	53	88.33
Non-availability of labour for hand hoeing/weeding.	48	80.00
Off-type plants or variety mixture in the crop	12	20.00
Rodents attack	38	63.33
Gap filling is required	40	66.66
Decrease in yield	22	36.66
Inadequate knowledge about cultivation practices of Direct Seeded Rice	32	53.33

The percent exceeds 100 due to multiple response.

Table 4. Distribution of respondents according to the reasons behind discontinuance of DSR cultivation

(N = 40)

Reasons for discontinuance	Frequency	Percentage*
Poor germination	27	67.50
Requirement of specific drill	37	92.50
High risk due to voluntary rice germination and incidence of rain at early stage	35	87.50
More weed infestation	40	100.00
Less yield of crop	15	37.50
More requirement of herbicides	40	100.00
Non-availability of DSR drill	4	10.00
Rodents attack	29	72.50
In DSR deficiency of		
a. Zinc	31	77.50
b. Iron	35	87.50

The percent exceeds 100 due to multiple response.

CONCLUSIONS

Direct seeded rice is a good alternative which not only saves money in the form of cut in labour expenses but also it saves water to some extent. There were many reasons which cause the discontinuance of direct seeded rice like infestation of weeds, non-availability of DSR drill and germination failure. So if we need to establish this technology we have to find out solid solutions to the problems faced by farmers in DSR. Otherwise, the present farmers distress will touch other levels.

REFERENCES

General Portal of Central Ground Water Board. (2014). *Groundwater year book-India*. Central Ground Water Board, Ministry of Water Resources, Government of India, Faridabad, India. Retrieved from http://www.cgwb.gov.in/GW-Year-Book-State.html.

Kaur, A. (2007). *Analysis of existing technology transfer system of vegetable cultivation in Ludhiana district* (Master's Thesis). Punjab Agricultural University, Ludhiana, India.

Kaur, K. (2015). *Problems and prospects of direct seeded rice in Punjab (Master's Thesis).* Punjab Agricultural University, Ludhiana, India.

Kaur, S. & Vatta, K. (2015). Groundwater depletion in Central Punjab: pattern, access and adaptations. *Current Science, 108,* 485-490.

Kumar, M.K.P., Gowda, D.K.S., Moudgal, R., Kumar, N.K., Gowda, K.T.P, & Vishwanath, K. (2013). Impact of fungicides on rice production in India. In Nita M. (Ed) *Fungicides-showcases of integrated plant disease management from around the world*, doi:10.5772/51009. Retrieved from http://www.intechopen.com/books/fungicides-showcasesof-integratedplant-disease.

Singh, D. (2016). *Adoption of water saving technologies in Sri Muktsar Sahib district of Punjab* (Master's Thesis) Punjab Agricultural University, Ludhiana, India.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 502-508
DOI: 10.5958/2322-0430.2018.00104.X

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Comparative Analysis of Knowledge Level of the Trained and Untrained Dairy Farmers of Punjab[!]

Parmveer Singh[1], Vipan Kumar Rampal[2] and Simran Kang Sidhu[3]*

[1]*Senior Research Fellow, Department of Extension Education, and* [3]*Professor of Sociology*
Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141004, and [2]*Deputy Director, KVK, Ropar*

[*]*Correspondence author's email: parmveer-coaext@pau.edu*

Received: January 01, 2018 *Manuscript Number: NS-18-78* *Revision Accepted: March 13, 2018*

ABSTRACT

The present investigation aimed at exploring the knowledge level of the dairy farmers. The ex-post-facto research design was selected for the study. A list of farmers was procured from Krishi Vigyan Kendras of Bathinda, Sri Muktsar Sahib and Mansa districts of Punjab. Out of the list, twenty trained farmers and an equal matching sample of 20 untrained dairy farmers was chosen by random sampling technique from these three selected districts. Hence, 60 trained and 60 untrained dairy farmers constituted the total sample of 120 farmers for the study. Knowledge was defined as the degree to which the factual information was possessed by the dairy farmers regarding recommended dairy management practices. Results indicated farmers more than 75 percent respondents had knowledge regarding important cross breeds of cows, estrous cycle, mucus discharge a heat symptom, amount of colostrums given to calf on the basis of body weight The difference analysis revealed that major differences in the knowledge of the trained and untrained dairy farmers was found to be in time taken to drop placenta, frozen semen bank of murrah buffalo, amount of concentrated mixture for pregnant dairy animal, balance feeding, dimensions of silage pits, symptoms of mastitis, cure of injured teats, right time to vaccinate against FMD, and right milking method. The overall analysis of the knowledge level revealed that majority of the trained and untrained dairy farmers (66.67 and 58.33 percent) had medium knowledge level regarding improved dairy management practices.

Keywords
Expost facto, knowledge, random sampling, training programme.

JEL Codes
M53, O13.

INTRODUCTION

In India, nearly 65 percent of the country's population is directly or indirectly engaged on agriculture but only agriculture is not able to provide necessary employment and income to all the people. Hence, dairying is supplementary and complementary activity to the agriculture (Ghoslya *et al.,* 2016). India ranks first with milk production 14.60 percent of world production. A total cattle population of India was 19.89 crores in which 16.58 crores (83.36 percent) belongs to indigenous variety with lower productivity due to ignorant scientific practices (Biswas *et al.,* 2016). Despite rapid advances in the animal husbandry technologies, productivity of this sector still is very low in India (Chander *et al.,* 2010). The dairy farming involves minimum land dependency and resource flexibility and also a source of income to major segment to rural betterment in small and marginal farmers (Bhatt, 2012). Dairying needs to be developed in a scientific manner to harness maximum potentiality of milch animals within available land (Singh *et al*., 2010). In India, most of the rural dairy farmers hardly follow dairy practices with full recommendations due to the complexity in terms of knowledge and skills in adoption of the dairy innovations (Lohakare *et al.,* 2015). The adoption of the dairy practices can be accelerated if the dairy farmers possess fair knowledge regarding the

[!]***This research article is part of the Master of Science thesis of the first author submitted to the Punjab Agricultural University, Ludhiana***

various scientific practices. Before investing the adoption of the dairy practices it's foremost important to ascertain the existing knowledge of the dairy farmers. Enhancing the scientific knowledge base of the dairy farmers would be first towards sustaining the dairy farming. English & English (1958) explained knowledge as a body of understood information possessed by an individual or a culture. A test is set of questions, each of which has a correct answer, to which people respond (Ray & Mondal, 1999). Bloom *et al*. (1995) explained test to those behaviours and test situations which emphasize remembering by the recall of idea, material, and phenomena. To determine the knowledge, an attempt was made to critically analyze the knowledge of the dairy farmers regarding major aspects of the dairy farming.

MATERIAL AND METHODS

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 investigation. Kerlinger (1973) explained ex-post–facto research as systematic empirical inquiries in which the scientists do not have direct control of independent variables, because their manifestations have already occurred or because they are inherently not manipulatable. 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 above 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 respective 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 for the investigation. The dairy farmers who possessed minimum three dairy animals such as cows/buffaloes or both were considered for the study. The knowledge test was developed to determine the knowledge of the dairy farmers. Knowledge was operationally defined as the degree to which the factual information possessed by the dairy farmers regarding recommended dairy management practices. Total 42 statements were framed under four dairy practices, that is, breeding, feeding, health care and miscellaneous management. Items pertaining to measure the cognition 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. The responses elicited from dairy farmers were quantified by assigning scores of 1 and 0 for correct and wrong/no response respectively. Data were collected by the enumerator personally on a pretested knowledge test by stating the objective of the study to the respondents. Every effort was made to receive the unbiased response of the respondents. The data were calculated with help of frequency and percentages. Also, difference analysis was carried out to highlight the knowledge gap among the trained and untrained dairy farmers. The level of the knowledge was found with the help of mean and standard deviation.

RESULTS AND DISCUSSION

The data pertaining to proportion of the respondents having knowledge regarding breeding, feeding, health care and miscellaneous management has been furnished below:

Knowledge of the Respondents Regarding Breeding Aspect of the Dairy Farming

The results pertaining to the different aspects of the breeding have been furnished in Table 1, it is evident that a vast majority of the trained dairy farmers were familiar with the important crossbreeds of cows (86.67percent) and breeds of buffalo (90.00 percent), estrous cycle (88.33 percent), frozen semen bank of the *murrah* buffalo (78.00 percent) Whereas untrained dairy farmers had knowledge regarding important breeds of the cows (65.00 percent), estrous cycle (75.00 percent) and mucus dischargeis a symptom of animal in heat (81.67 percent). Difference analysis revealed that major difference among the knowledge of trained and untrained dairy farmers was found in important cross breeds (21.67 percent), insemination after calving (38.33 percent), time taken to drop placenta (46.67 percent), frozen semen bank for *Murrah* buffalo (68.33 percent), and isolation symptom of animal in heat (40.00 percent). Also, it was observed that 13.33 and 5.00 percent of the untrained dairy farmers possessed better knowledge regarding time of pregnancy test after the insemination and time of removal of the placenta

Knowledge of the Respondents Regarding Feeding Practices of the Dairy Farming

A glance at Table 2 reveals that majority of the trained dairy farmers possessed knowledge regarding the ingredients for homemade feed (91.67 percent), right time to feed colostrums to calf (71.67 percent), amount of concentrated mixture for pregnant dairy animal (80.00 percent), quantity of colostrums given to calf on basis of body weight (88.33 percent) whereas the about two third of the untrained dairy farmers (63.33 percent) exhibited knowledge regarding amount of colostrums given to calf on basis of body weight (78.33 percent). Difference analysis revealed that there was vast difference in the knowledge of the trained and untrained dairy farmers regarding the ingredients for homemade feed (56.67 percent), balance feeding to animals (53.33 percent), amount of concentrated mixture for pregnant dairy animal (46.67 percent) and dimensions of the pit size (46.67 percent).

Knowledge of the Respondents Regarding Health Care Practices of the Dairy Farming

A perusal of Table 3 reveals that majority of trained dairy farmers (93.33, 88.33, and 81.67 percent) were acquainted with symptoms of the FMD, H.S disease an Mastitis and vaccination of such diseases (88.33 percent) and identification of such diseases (81.67percent) while nearly three four (71.00 percent) of untrained dairy farmers had knowledge regarding symptoms of FMD, 66.67 and 58.33 percent of the untrained dairy farmers were having knowledge regarding the various infectious diseases and time of injection against FMD respectively, and half the untrained dairy farmers had identification of the non infectious and parasitic diseases. Difference analysis revealed that there was not much difference found in the knowledge of trained and untrained dairy farmers in aspects such as advantages of vaccination and age of castration (8.33 percent) and injection against FMD and month of castration (6.67 percent) but there was knowledge gap in cure of the injured teats (58.33 percent) followed against the symptoms of mastitis (46.67 percent).

Knowledge of the Respondents Regarding Miscellaneous Management of the Dairy Farming

Data furnished in Table 4 reveal that equal proportion of the trained dairy farmers (83.33 percent) had knowledge regarding length of dry period or lactating pregnant buffalo and right method of milking and also, around 70.00 percent of trained dairy farmers had knowledge about the practices for clean milk production, clean milk production, cleanliness of *pucca* floor, dehorning of calf. The two third of the trained dairy farmers exhibited knowledge regarding indicators of the good milch animal whilst 61.67 percent of the untrained dairy farmers had practices for clean milk production, right method of milking (58.33 percent), indicators of the good milch animal (55.00 percent) followed by body weight of good milch animal (46.67 percent). Difference analysis revealed that there was considerable difference in dry period for lactating pregnant buffalo (45.00 percent), milking with teats (46.67 percent) and dehorning of calves (30.00 percent).

A critical analysis of the findings revealed that the major knowledge gap exists in technical aspects of the dairy farming. The knowledge of the farmers in traditional practices was also reported to be high but they comparatively lacked knowledge in aspects regarding time taken to drop placenta, frozen semen bank of *Murrah*

Table 1. Distribution of respondents according to knowledge about various aspects of breeding in dairy management

(n_1=n_2=60, percent)

Aspects	Trainees	Non-trainees	Difference
Important crossbreeds of cows	86.67	65.00	21.67
Important breeds of buffaloes	90.00	75.00	15.00
Timing of artificial insemination	60.00	46.67	13.33
Pregnancy test after insemination	30.00	43.33	-13.33
Estrous cycle	88.33	75.00	13.33
Time of insemination after calving	70.00	31.67	38.33
Time of removal of placenta	51.67	56.67	-5.00
Time taken to drop placenta	76.67	30.00	46.67
Frozen semen bank for *jersey* cow	33.33	23.33	10.00
Frozen semen bank for *Murrah* buffalo	78.33	10.00	68.33
Mucus discharge a symptom of animal in heat	91.67	81.67	10.00
Isolation a symptom of animal in heat	70.00	30.00	40.00

Table 2. Distribution of respondents according to knowledge about various aspects of feeding in dairy management

(n_1=n_2=60, percent)

Aspects	Trainees	Non-trainees	Difference
Ingredients for homemade feed	91.67	35.00	56.67
Time for colostrums feeding to calf	71.67	63.33	8.33
Amount of concentrated mixture for pregnant dairy animal	80.00	33.33	46.67
Balance feeding	75.00	21.67	53.33
Day schedule for feeding of crossbred cows	55.00	36.67	18.33
Daily requirement of green fodder to dairy animal	40.00	35.00	5.00
Dimensions of silage pit	65.00	18.33	46.67
Amount of colostrums given to calf on basis of body weight	88.33	78.33	10.00

buffalo, amount of concentrated mixture for pregnant dairy animal, balance feeding, dimensions of silage pits, symptoms of mastitis, cure of injured teats, right time to vaccinate against FMD, and right milking method. The aspects are highly contributory for the sound breeding, feeding practices, health care and overall dairy management of the dairy management, it highlights the need for training programmes, regular contacts of the extension personnel, camps, to enhance and reinforce the existing knowledge and updates the knowledge of the dairy farmers and to provide them scientific outlook. The spread of the dairy knowledge via mass media sources of information will also play key role in providing timely knowledge about the these aspects.

Descriptive Statistics of the Knowledge Score of the Trained and Untrained Dairy Farmers

The critical analysis of the Table 5 reveals that average mean score and standard deviation of the breeding aspect of the trained dairy farmers was 8.70±1.65 whereas it was reported to be 5.68 ± 1.67 in case of untrained dairy farmers. The average mean score and standard deviation of the feeding and health care aspects of the trained dairy farmers were recorded to be 5.67± 1.28 and 9.97 ± 1.59 respectively, whereas it was found to be 3.27 ± 1.50 and 6.36 ± 1.90 respectively, in case of the untrained dairy farmers. The mean scores and standard deviation of knowledge of trained and untrained dairy farmers regarding miscellaneous management was found to be 5.70 ± 1.1 and 3.92 ± 1.49, respectively.

Knowledge Level of Respondents about Breeding Aspect of IDMPs

It is evident from the Table 6 that majority of trained dairy farmers (66.67 percent) possessed medium level of knowledge regarding improved breeding practices followed by 31.67 percent of them who were in high category. On the other hand, majority of untrained dairy farmers (70.00 percent) possessed medium level of knowledge regarding improved breeding practices

Table 3. Distribution of respondents according to knowledge about various aspects of healthcare in dairy management

(n_1=n_2=60, percent)

Aspects	Trainees	Non-trainees	Difference
Symptoms of FMD	93.33	71.67	21.67
Symptoms of H.S. disease	80.00	43.33	36.67
Symptoms of mastitis	81.67	35.00	46.67
Vaccination against infection disease	88.33	53.33	35.00
Month of male castration	30.00	23.33	6.67
Advantages of vaccination	71.67	63.33	8.33
Age of male castration	56.67	48.33	8.33
Injection against FMD	65.00	58.33	6.67
Curing the injured teats	75.00	16.67	58.33
Right time of vaccination of FMD	68.33	21.67	46.67
Right time of vaccination of H.S. disease	71.67	35.00	36.67
Infectious disease	81.67	66.67	15.00
Non infectious	65.00	50.00	15.00
Parasitic disease	68.33	50.00	18.33

Table 4. Distribution of respondents according to knowledge about various aspects of miscellaneous management in dairy management

(n_1=n_2=60, percent)

Aspects	Trainees	Non-trainees	Difference
Practices for clean milk production	71.67	61.67	10.00
Cleanliness of *pucca* floor	73.33	53.33	20.00
Dry period for lactating pregnant buffalo	83.33	38.33	45.00
Dehorning of calf	71.67	41.67	30.00
Right method of milking	70.00	58.33	11.67
Milking with teats	83.33	36.67	46.67
Indicators of good milch animal	66.67	55.00	11.67
Body weight of good milch animal	50.00	46.67	3.33

followed by 30.00 percent of them who fell in low category of knowledge level. The results indicate that majority of trained and untrained dairy farmers had high knowledge about the selection of breeds, symptoms of animal in heat and estrous cycle. These are fundamental practices that one should know as an entrepreneur to manage a dairy. Therefore, there was not much difference between the knowledge level of trained and untrained dairy farmers with regard to these practices. However, above (70-80percent) of the trained dairy farmers had moderate to high knowledge about the timing of A.I., pregnancy test after insemination, insemination after calving whereas majority of untrained dairy farmers (60-80percent) had moderate to low knowledge level about these practices. This is due to the fact that trained farmers were following pregnancy test whereas untrained dairy farmers were not following the pregnancy test. This difference might be due to awareness of the trained farmers as compared to untrained dairy farmers. This can be due to training given by the KVKs, as the trained dairy farmers gained knowledge as compared to untrained dairy farmers about these practices. The moderate knowledge of the untrained dairy farmers might be due to their high experience in dairying but lacked complete technical knowledge because of not undergoing any training programme. Similarly, both trained and untrained dairy farmers had low knowledge about the semen bank of *jersey* cow, so there is need to lay stress on these aspects during the training programme conducted by the KVKs.

Knowledge Level of Respondents about the Feeding Aspect of IDMPs

Data tabulated in Table 6 depict that majority of trained farmers (71.67 percent) fell in medium category of knowledge regarding the feeding aspect followed by 28.33 percent of them having high knowledge regarding this aspect whereas majority (70.00 percent) of untrained farmers possessed medium level of knowledge followed by the 30.00 percent of them had low knowledge regarding the feeding aspect. In case of feeding practices, majority of the trained and untrained dairy farmers had high knowledge and moderate knowledge respectively, regarding time of feeding of colostrums to newly born calves (71.00 percent and 63.33 percent) and amount of colostrums given to calf on the basis of body weight (88.33 percent and 78.33 percent). The plausible reasons for the above findings can be attributed to positive impact of training on trained dairy farmers as compared to untrained dairy farmers.

Knowledge Level of Respondents about Animal Health Care Aspect of IDMPs

A critical perusal of Table 6 reveals that 38.33 of trained and a small proportion (3.33 percent) of untrained farmers had high knowledge about the healthcare aspect of IDMPs whereas, an equal proportion (61.67percent) of the trained and untrained farmers possessed medium level of knowledge regarding this aspect, however, 35 percent of untrained farmers had low knowledge regarding this aspect. Under healthcare practices, majority of trained

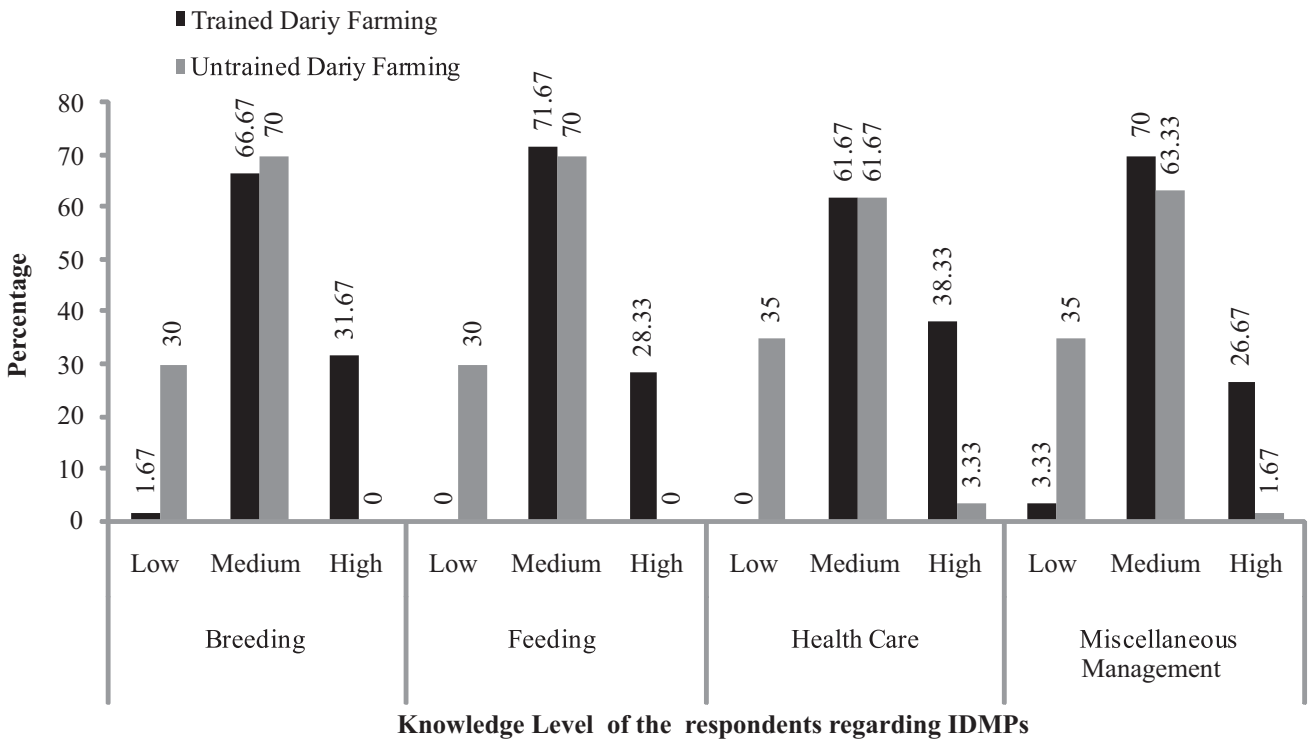


Figure. 1. Distribution of respondents according to their overall knowledge level about the IDMPs

and untrained farmers had high knowledge regarding major diseases of dairy animals and symptoms of foot and mouth disease because most of the dairy farmers were aware of commonly occurring diseases. A considerable percentage (above 80 percent) of trained dairy farmers had knowledge regarding symptoms of foot and mouth disease, H.S, mastitis, vaccination against infectious disease. It was noticed that 40-70percent of untrained farmers have a moderate to low knowledge of these aspects of health care. The reasons could be attributed that it is difficult to understand the nature of symptoms and causes for diseases.

Knowledge Level of the Respondents about the Miscellaneous Management Aspect of IDMPs

A glimpse of Table 7 indicates that majority (70.00 percent) of trained farmers had medium level of knowledge regarding miscellaneous management followed by high (26.67 percent) and low (3.33 percent) level of knowledge whereas majority (63.33 percent) of untrained dairy farmers had medium level of knowledge followed by low (35.00 percent) knowledge level regarding this aspect. In case of miscellaneous management practices, majority of the trained and untrained dairy farmers had high knowledge regarding the clean milk production and maintaining cleanliness of cattle shed. Whereas majority of trained farmers (83.33percent) had high and 38.33 percent of the untrained dairy farmers had low level of knowledge regarding dry period for lactating pregnant animal respectively. Similarly, trained farmers had high knowledge level regarding right method of milking as compared to untrained dairy farmers who had low knowledge level about the aspect of management because of the trained farmers got training from KVKs, Thus, they gained knowledge as compared to untrained farmers.

Table 7. Distribution of respondents according to their overall knowledge level about the IDMPs

(n_1=n_2=60, percent)

Overall Knowledge Level	Categories	Trainees	Non-trainees
	Low (<18.02)	-	41.67
	Medium (18.02- 31.19)	66.67	58.33
	High (>31.19)	33.33	-

Overall Knowledge Level of Respondents about IDMPs

As far as knowledge level of respondents about the IDMPs was concerned, the data presented in Table 7 portray that 66.67 percent of the trained dairy farmers had medium level followed by 20 percent of them who possessed high knowledge level of IDMPs while 58.33

Table 5. Descriptive statistics of the knowledge score of the trained and untrained dairy farmers

Areas	Items	Trainees (n_1=60)		Non-trainees (n_2=60)	
		Mean ± SD	Max.-Min.	Mean ± SD	Maxi.-Min.
Breeding	12	8.70±1.65	11-4	5.68 ± 1.67	9-2
Feeding	8	5.67±1.28	8-3	3.27±1.50	6-0
Health care	14	9.97±1.59	14-6	6.36±1.99	11-2
Miscellaneous management	8	5.70±1.11	8-3	3.92±1.49	8-1

Table 6. Distribution of the respondents according to their knowledge level regarding improved dairy management practices

(n_1=n_2=60, percent)

Areas	Categories	Trainees (n_1=60)	Non-trainees (n_2=60)
Breeding	Low (<4.95)	1.67	30.0
	Medium (4.95-9.43)	66.67	70.00
	High (>9.43)	31.67	-
Feeding	Low (<2.59)	-	30.00
	Medium (2.59-6.29)	71.67	70.00
	High (>6.29)	28.33	-
Health care	Low (<5.62)	-	35.00
	Medium (5.62-10.72)	61.67	61.67
	High (>10.72)	38.33	3.33
Miscellaneous management	Low (<3.23)	3.33	35.00
	Medium (3.23-6.39)	70.00	63.33
	High (>6.39)	26.67	1.67

percent of the untrained dairy farmers had medium level followed by 41.67 percent of the respondents who fell in low knowledge level of IDMPs.

CONCLUSIONS

It was observed that there exists a wide knowledge gap between the trained and untrained dairy farmers. A majority of the dairy farmers had medium knowledge level, there is intense need to uplift the knowledge level and lay more emphasis on the weak aspects, specialized trainings on those aspects should be organized. Trainings, extension services, camps, and lectures should be organized to enhance the technical knowledge of the dairy farmers which would help to adopt the scientific dairy practices.

REFERENCES

Bhatt, P.M. (2012). Study on extent of knowledge of dairy farmers regarding improved animal husbandry practices under VRCs Programme. *Indian Research Journal of Extension Education (Special Issue) 2,* 117-119.

Biswas, D.S., Mazumdar., & Goswami, A. (2016). Development of cognitive learning scale to test knowledge of dairy farmers on dairy farming practices. *International Journal of Agricultural Research and Crop Sciences, 1,* 28-32.

Bloom, B.S., Bhoelhardt, M., Furot, S., Hill, W., & Krathwhol, D.R. (1956). Taxonomy of education objective: The cognitive domain. New York: Longman's Green and Company.

Chander, M., Dutt, T., Ravikumar, R., & Subrahmanyeswari, B. (2010). Livestock technology transfer service in India: A review. *The Indian Journal of Animal Science*, *80,* 1115-1125.

English, H.B., & English, A.C. (1958). *A comprehensive dictionary of psychological analytical terms*. New York: Green & Co., Longman's.

Ghoslya, A.K., Bairathi, R., & Sharma, F.L. (2016). Knowledge and adoption dynamics of milk producers of Udaipur district of Rajasthan. *Indian Research Journal of Extension Education,16* (3), 16-19.

Kerlinger, F.N. (1973). *Foundation of behavioural research.* Bangalore: PRISM Books Pvt. Ltd.

Lohakare, A.C., Kamdi, B.P., Nakade, M.K., Basunathe, V.K., & Banthiya, V. (2015). Extent of knowledge of improved animal husbandry practices and socio-economical, psychological characteristics of dairy farmers of Yavatmal district of Vidarbha (Maharashtra). *Veterinary Science Research Journal, 6*(1), 23-31.

Ray, G.L., & Mondal, S. (2004). *Research methods in social sciences and extension education*. Noida (U.P.): Kalyani Publishers,

Singh, S., Kumar, R., & Meena, B.S. (2010). Adoption level of scientific dairy farming practices by dairy farmers of Haryana. *Indian Research Journal of Extension Education, 10* (3), 45-48.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 509-512
DOI: 10.5958/2322-0430.2018.00105.1

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Protective Products for Agricultural Activities

Rajdeep Kaur[1], Sandeep Bains[1], and Manisha Sethi[3]*

[1]Assistant Scientist, [2]Senior Scientist-cum-Head, and [3]Research fellow, Department of Apparel and Textile Science Punjab Agricultural University, Ludhiana-141004

[*]Corresponding author's email: msrajdeepct@pau.edu

Received: January 15, 2018 *Manuscript Number: NS-18-94* *Revision Accepted: March 10, 2018*

ABSTRACT

India has world's largest number of agriculture workers. Most of the farmers have small land holdings, therefore, activities like sowing, transplantation, weeding, manure and pesticide application, harvesting etc. are performed manually. Both males and females work hand-in-hand during most of the farm activities. Due to manual work, there are greater chances of farm accidents, mishap, fatality, production loss time and other burdens on farmer's well-being. For this, protective products can be used to avoid such mishaps at the root level. Keeping this in mind, waterproof garments were constructed i.e. mask, mixing mat, apron, gloves and hood by sandwiching the polythene sheet within two layers of waste/ used fabric. The developed products were provided to the farmers/ farm women working in fields engaged in different agricultural activities like mixing of pesticides, pesticide application, seed treatment etc. The results showed that gloves (WMS 5.66) were the most preferred protective product used for majority of the farm activities. It was followed by apron with WMS of 4.73. Since the hood was not used for all farm activities, so it was the least preferred product with WMS of 3.4. It was observed that these products if developed at home can help to save money. It can further help in capacity building of the rural women.

Keywords
Fabric, farmers, protective products, pesticides, polythene.

JEL Codes
O13, O14, Q15.

INTRODUCTION

India is a country with people of different cultural background and community. Clothing is treated differently here. Owing to the significant social meaning held by textiles, clothing is rarely discarded. Instead, it is frequently recycled for both the domestic and global markets. Reuse of textiles was a domestic craft in India. Quick discarding of clothes contributes to landfill. Up-cycling can give clothes a second life with a unique identity and can altogether bring sustainability. Practicing up-cycling is to cut down the cost required in investment in raw materials, craftsmanship, tailoring and other resources needed in manufacturing.

On a global scale, agricultural accidents place a great burden on the economy, resulting in reduced return on investment in agriculture. Moreover, the burden of injuries/illness is on the increase with the quest of mechanization and commercialization of the sector as rightly illustrated by Olowogbon & Fakayode (2013). There will be greater chances of farm accidents, mishap, fatality, production loss time and other burdens on farmer's well-being.

Personal protective clothing is required where farmers may be exposed to such hazards as toxic or corrosive chemicals, biological pathogens, thermal extremes, etc. Using protective clothing, while working with pesticides, helps to reduce the risk of exposure to pesticides and pesticide poisoning. As stated by *Ogg et al.* (2012), laminated polyethylene gloves are needed for mixing, loading, and applying pesticides. Most of these gloves are available in reusable pairs that can be cleaned after each mixing/loading task or pesticide application. Others, such as nitrile gloves, are available in single-use disposable versions in a variety of mil weights.

As highlighted by Rani *et al.* (2014) in her study, apron was assessed to be highly suitable with reference to skin protection provided by fabric. Masks made from cambric fabric were found to be highly suitable with

regards to ease of wearing and removing, coverage of face and appearance. The elastic at sides of mask was used to keep it in position. Gloves provided to the male farm workers were found to be highly suitable as these protected hands from itching, irritation and cuts and sores.

Waste garments like suits, *dupattas*, sarees, bedsheets, pants etc. can be used to develop usable waterproof garments and protective clothing such as aprons, coveralls, coats, pants, hats, hoods, sleeves, gloves. These garments will be cost effective due to the use of second-hand clothes in production of newer garments. Further, these products can be prepared and sold out at local markets by rural women. This will help them to overcome the financial problems and become an earning hand to the family.

Pesticide application requires protective clothing such as long-sleeved shirt, pants, socks, and shoes or boots (Hansen & Walker, 2015). Clothing should be pesticide-free and made of tightly woven fabric. Other labels may require the applicator to wear a waterproof or chemical resistant coverall or use a chemical-resistant apron if duties include mixing and/or loading pesticides. Aprons should cover the front of the body from chest to boots.

Personal protective clothing is designed to keep toxic substances such as pesticides from getting on or in your body. The law requires one to wear protective clothing if it is specified on the label of the pesticide being used. It helps to protect different parts of the body. Some protective clothing are chemical resistant like coveralls, aprons, gloves, boots, hoods. Other protective equipment may include respirators, safety glasses or goggles.

Protective clothing should be used whenever handling pesticides (such as mixing, applying, storing, and disposing), cleaning equipment, touching freshly treated surfaces, or laundering contaminated clothing. Studies show that over 90 percent of chemical exposure occurs through the skin. To reduce the pesticide exposure, different products using textile waste and non-biodegradable waste can be used. Masks, hood, apron, gloves, may have been prepared by sandwiching non-degradable waste in fabric.

METHODOLOGY

Polythene film is one of the most lightweight and durable packaging media available and hence can be used to make waterproof garments. The polythene bags that one gets from the grocery store can be quite nuisance, but these polythene bags and leftover textile waste can be reused in a profitable manner. Waterproof garments were constructed by sandwiching the polythene sheet within two layers of waste/ used fabric. These developed products can be used for daily use. Mattresses, bib, mats can be used for kids. Hood, apron, gloves etc. can be used while working in the fields.

The data was collected from thirty farmers/ farm women (15 males and 15 females) of Kaddon village. The developed products were provided to the farmers/ farm women working in fields engaged in different agricultural activities like pesticide application, seed treatment etc. After using these products the respondents gave their preferences as Most preferred (3), Preferred (2), Least preferred (1) and Not preferred (0). WMS and ranking was calculated for each product. Price of homemade products and the products available in market was compared.

RESULTS AND DISCUSSION

The socio-personal profile of farm workers working in the agricultural fields is given in Table 1.

It is evident from the Table 1 that less than half (43.33 percent) of the respondents were from the age group of 30-40 years, followed by respondents within the age group of 20-30 years (26.67 percent), 40-50 years (23.33 percent). The rest (6.67 percent) were above 50 years of age. Fifty percent of the respondents each were male and female. The literacy level of the farm workers have been divided only into two categories, which include illiterate and education up to primary level. Illiterate migrant labour constituted of 73.33 percent, and the rest 26.67 percent had acquired their education only up to primary level.

Table 1. Socio-personal profile of the farm workers

(n= 30)

Age group (Years)	No. of respondents	Percentage
20-30	08	26.67
30-40	13	43.33
40-50	07	23.33
Above 50	02	06.67
Sex		
Male	15	50.00
Female	15	50.00
Level of education		
Illiterate	22	73.33
Up to primary	08	26.67

The utility of the protective products was studied and the preferences for the developed protective products were taken in regards of different activities.

Mat: Besides killing insects, pests etc., pesticides also kill beneficial insects, such as parasites, predators etc., thus disturbing the balance in nature. Since mixing of pesticides, preparation of solution of pesticides, or seed treatment with pesticides is done by keeping the pesticide sprayer and other associated equipments on the ground leaving the ground contaminated. For this farmer/ farm, women can make the use of mat, prepared from fabric sandwiched with the polythene instead of keeping those equipments directly on the ground.

As evident in Table 2, it was observed that all the female respondents preferred mat for seed treatment and mixing of pesticides, while 46.67 percent and 73.33 percent of the male respondents preferred mat for seed treatment and mixing of pesticides respectively. Mat was

not required for spraying of pesticides.

Mask: As it is a known fact that dust, sprays, and fumes enter the body through the lungs. So to avoid the inhalation of pesticides, the applicator/farmer should use protective mask while spraying in field.

It was found that 93.33 percent of females and 60 percent of males preferred mask for mixing of pesticides, 46.67 percent females and all the male respondents preferred mask for spraying pesticides. Only 13.33 percent of the female respondents preferred mask for seed treatment.

Apron, gloves, and hood: Pesticides enter the body when liquid pesticides splash or spill on clothes or directly when in contact with the skin. Skin also absorbs pesticides in dust form. Cuts, abrasion, sores, and wetness on the skin allow pesticides to enter more easily. So to get rid of exposure to skin from pesticides apron and gloves can be used. While spraying on the climbers of higher heights the head and face of the pesticide applicator gets exposed to pesticide particles. For this hood, having waterproof quality can be used.

In the case of apron, it was noticed that 86.67 percent of female respondents and 40 percent of the male respondents preferred it for mixing of pesticides, 53.33 percent of female respondents and 60 percent of the male respondents for seed treatment and 46.67 percent of the female respondents and all the male respondents preferred it for spraying of pesticides. Gloves were preferred by all the female respondents and 73.33 percent of the male respondents for seed treatment, all the female and male respondents preferred it for mixing of pesticides and 46.67 percent and all the male respondents preferred it for spraying the pesticides.

Among all the protective products evaluated in the study, gloves were the most preferred product with highest WMS of 5.66 and were given first rank, followed by apron with WMS of 4.73, mask with WMS of 4.6. The last rank was given to hood with WMS of 3.4 (Table 3).

The price of the developed products was compared with the market value. These products if developed at

Table 2. Preference for protective products used for different agricultural activities

Activities	Seed treatment		Mixing of pesticides		Spraying pesticides	
	Female	Male	Female	Male	Female	Male
Mat	15 (100)	7 (46.67)	15 (100)	11 (73.33)	-	-
Mask	2 (13.33)	-	14 (93.33)	9 (60)	7 (46.67)	15 (100)
Apron	8 (53.33)	9 (60)	13 (86.67)	6 (40)	7 (46.67)	15 (100)
Gloves	15 (100)	11 (73.33)	15 (100)	15 (100)	7 (46.67)	15 (100)
Hood	-	-	-	-	6 (40)	15 (100)

Figures in parentheses are percent to the total.

Table 3. Ranking of protective products in respect to their utility

(n=30)

Products	Most preferred (3)		Preferred (2)		Least preferred (1)		Not preferred (0)		WMS	Rank
	Female	Male	Female	Male	Female	Male	Female	Male		
Mat	14 (2.8)	3 (0.6)	1 (0.13)	3 (0.4)	-	9 (0.6)	-	-		IV
Mask	-	15 (3.0)	9 (1.2)	-	6 (0.4)	-	-	-	4.6	III
Apron	4 (0.8)	12 (2.4)	7 (0.93)		4 (0.27)		-	-		II
Gloves	13 (2.6)	12 (2.4)	2 (0.26)	3 (0.4)	-	-	-	-		I
Hood	-	10 (2.0)	6 (0.8)	3 (0.4)	1 (0.07)		8 (0.0)	-		V

Figures in parentheses are mean scores.

home can help to save money.

Figure 1 reveals that there was a saving of 86.67percent in the case of mat, 85 percent in the case of apron, 72.72 percent for hood, 50 percentin the case of gloves and 40 percent in the case of mask when developed at home using waste textiles and polythene. Farm women can develop these products at home and can earn their livelihood in a better way. This can help in capacity building of rural women.

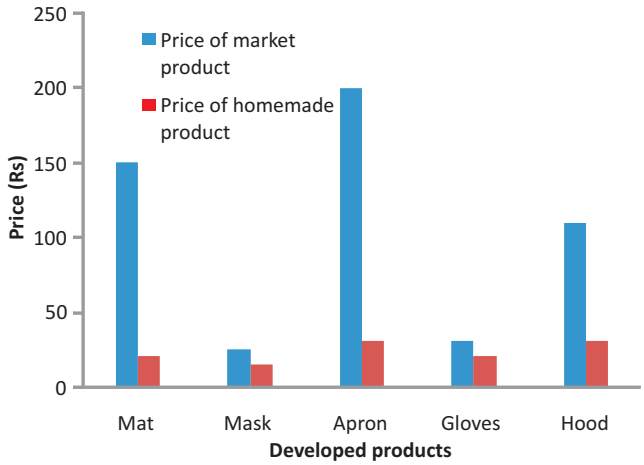


Figure. 1. Price of the homemade products in comparison to market products

CONCLUSIONS

Protective products were constructed by sandwiching the polythene sheet within two layers of waste/ used fabric. These protective products tend to save the agricultural workers from various health hazards. These protective products can be used while seed treatment, mixing and spraying of different pesticides. Gloves were the most preferred product for providing protection. The price of the developed products was compared with the market price. It was observed that these products if developed at home can help to save money. It can further help in capacity building of the rural women.

REFERENCES

Hansen, P., & Walker, T. (2015). *Agricultural pesticide personal protective equipment*. Colorado State University Extension.

Ogg, C.L., Bauer, E.C., Hygnstrom, J.R., & Hansen, P.J. (2012). *Protective clothing and equipment for pesticide applicators.* NebGuide, University of Nebraska–Lincoln Extension

Olowogbon, S.T., & Fakayode, S.B (2013). Commercializing agriculture in Africa: The Environmental, health,and safety implications and the way forward. Paper presented at the *4th International of the African Association of Agricultural Economists* held at Hammamet, Tunisia.

Rani, P., Pruthi, N., Singh, S.S. Jeet. & Makkar, P. (2014). Protective clothing for male farm workers engaged in wheat threshing. *Asian Journal Home Science, 9*(1), 38-43.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 513-521
DOI: 10.5958/2322-0430.2018.00119.1

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Potential and Constraints in Contract Farming of Chicory Cultivation

Parminderjeet Singh and Baljinder Kaur Sidana*

Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141004, Punjab

**Corresponding author's email: baljindersidana@gmail.com, parminder1436@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-107* *Revision Accepted: March 11, 2018*

ABSTRACT

The present paper analyzes the potential and constraints of chicory, a crop introduced in Punjab agriculture through contract farming in the Punjab state. Primary data pertaining to the year 2014-15 was collected through purposive sampling technique from a sample of 60 chicory growers scattered over 38 villages of five districts of Punjab namely Amritsar, Jalandhar, Gurdaspur, Hoshiarpur and Tarn Taran. The average operational holding was 15.06 hectares, out of which, on an average 8.12 hectares was owned by the sample farmers and 6.94 hectares was leased in. 85 percent of the farmers cultivated upto 3 hectares of land in chicory cultivation. Out of the hired labour-use, hoeing covered a major proportion 50.12 percent followed by harvesting 49.14 percent, i.e. respectively. Thus, major share of human labour was used on two operations that is, hoeing and harvesting, leaving 5 to 6 percent of labour-use on rest of operations. The total machine used was 88.60 hours per hectare which comprised of 88.05 hours of owned machine and 0.55 hours of hired machine. The operational cost for cultivating chicory came out to be ₹59620per hectare. The cost incurred on human labour came out to be ₹3144 per hectare for family and attached labour, whereas it was ₹30434 on hired labour. The average production of chicory came out to be 343.69 q per ha. The average price realized was ₹335.25 per quintal. Thus the gross returns came out to be ₹115202 per ha. The returns over variable cost came out to be ₹55582 per ha. As the gross returns were higher than operational cost of cultivating chicory, a benefit-cost ratio of 1.93 was realized. The regression coefficients for crop duration and tractor use came out to be positively significant at one percent level indicating that if crop duration and tractor use is increased by one percent, the productivity of chicory would increase by 1.033 and 0.457 percent respectively. The regression coefficient for seed was negatively significant indicating that one percent increase in seed rate would decrease chicory productivity by 0.375 percent. The important constraints in the cultivation of this crop were delayed payment, high wages of hired labour, inadequate facilities for unloading the crop and lack of technical knowledge.

Keywords
Chicory, contract farming, cost-benefit analysis, resource-use efficiency.

JEL Codes
O13, Q10, Q12, Q16.

INTRODUCTION

Cichorium intybus L, belonging to the Asteraceae family, is an erect perennial herb 80-90 cm in height with a fleshy taproot up to 75 cm in length. The genus *Cichorium* consists of six species with major distribution areas in Europe and Asia. It is cultivated in countries such as the UK, Belgium, France, the Netherlands, Germany, South Africa, the USA, and India. It is also known as common chicory, blue sailors succory, and kasini. It is native to the Mediterranean region, Mid-Asia and Northern Africa. Historically, chicory was grown by the ancient Egyptians as a medicinal plant, coffee substitute, vegetables crop, and occasionally for animal forage. In India chicory is cultivated in the Bihar, Gujarat, Himachal Pradesh, and Tamil Nadu. Chicory has been successfully cultivated in India since 1918 at Coimbatore and subsequently Nilgiris in Tamil Nadu and at Broach, Amalsad, and Jamnagar in Gujarat. Initially, chicory seed was imported into India, but nowadays, it is successfully produced locally. Commercial seed production is undertaken in Jammu and Kashmir, temperate areas of Himachal Pradesh and some hilly regions of Uttar Pradesh. The agro-climatic conditions of these dry temperate areas are conducive to quality seed production (Bais *et al*., 2001).

Chicory is a perennial crop, generally grown in winter season. 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. Chicory is considered as both complementary (in blending) as well as supplement to coffee. The crop is cultivated in few states mainly, Uttar Pradesh and Gujarat. The two states together accounts for 97 percent of the total production of chicory in India. It is the climate or soil conditions which favours chicory in these states. Though the crop has gained momentum in production, processing, and consumption in India and World, it is yet to gain its potential in Indian context (Haque *et al*., 2014).

The marketing of chicory mixed coffee in India started in 1950's by M/S Brooke bond India limited which later merged with Hindustan lever limited. In the 1950's while initiating its activities BBIL started contract farming with farmers in Jamnagar and later spread to other areas in Gujarat, Uttar Pradesh, and Tamil Nadu. The limited usages of chicory have also influenced the linkages between the chicory producers and manufactures of coffee. Its cultivation in India started on contract basis mainly because of lack of large open market and lack of feasibility of production of seeds in India. The situation has remained unchanged with total demand continuing to be shared between the manufacturers of coffee products and retailers of coffee. Attempts to produce chicory seeds in India have more or less failed. These two reasons have compelled the chicory growers to remain linked to the buyers through a contract. Chicory is traded in the form of dried roots which are obtained after slicing and sun drying the fresh chicory roots or chicory powder obtained after roasting and grinding the sun-dried roots (Kurian, 2007).

The old estimates suggest that the world consumption of chicory powder is anywhere between 1.1 to 1.2 lakh tonnes with France and India accounting for major consumption. The historical data suggests that quantity of the chicory roots used for preparation of chicory powder estimated to vary from 34 to 35 thousand tonnes per year (100 kg of dry chicory roots yield about 70 kg of chicory powder). It is stated that about 80 to 85 percent of the coffee consumed in India contains varying proportion of chicory ranging from 30 percent upward. The ratio in the end product can reach as high as 50:50 and yet it is sold as coffee. Thus, chicory being a product with limited usage and nearly static demand generates its own market dynamics. As against its limited usage, its main advantage is in terms of its relatively low price as compared to coffee. Therefore, 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). 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. It is expected that the farmers would get better returns on growing chicory cultivation than wheat if grown successfully. In this context, the present study aimed to examine the resource-use efficiency of chicory cultivation in Punjab.

MATERIAL 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 namely, 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, and 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.

Regression Analysis

To examine the factors affecting the productivity of chicory crop,double log production function popularly known as Cobb-Douglas production function was considered the most appropriate with respect to the magnitude and significance level of the coefficients and value of R^2 (coefficient of multiple determinations). Many production functions were tried but Cobb-Douglas production function gave the best results and was used for the present analysis.

$$y \quad a_0 \; {}_{i\ 1}^{n} \; x_i^{ai}, i \quad 1,2,..., n$$

Where y represents the yield per hectare of chicory crop under study, x_i the selected explanatory variables (per hectare). The constants a_0 and a_i (i= 1,2,….,n) represent the efficiency parameter and the production elasticities of the respective input variables (Sankhayan, 1988). The estimated form of the equation becomes:

$$\ln y \quad \ln a_0 \; {}_{i\ 1}^{n} \; a_i \ln x_i I \quad 1, 2, \text{-n}$$

$$\ln y = \ln a_0 + a_1 \ln x_1 + a_2 \ln x_2 + \text{--------} + a_8 \ln x_8$$

Where,

y = Yield per hectare of chicory crop (kg)

x_1 = Seed (kg per ha)

x_2 = Urea (kg per ha)

x_3 = Potash (kg per ha)

x_4 = Crop duration (No. of days)

x_5 = Weedicide usage (₹ per ha)

x_6 = Insecticide usage (₹ per ha)

x_7 = Family labour (hours per ha)

x_8 = Tractor use (hours per ha)

Resource-use efficiency

The basic criterion of an efficient resource-use is that ratio of marginal value product (MVP) of a factor to the marginal factor cost (MFC) is equal to one. If MVP > MFC, then it means underuse of input and if MVP < MFC then it means overuse of output. The marginal value productivity (MVP) of the ith output was calculated as following:

$$MVP \quad a_i \frac{\bar{y}}{\bar{x}_i} Py$$

Where,

a_i = regression coefficient of ith input

y = geometric mean level of chicory productivity per hectare

x_i = geometric mean level of the ith input used

Py = price of chicory

Resource-use efficiency was calculated by the ratio of MVP's of each resource with their corresponding factor cost.

RESULTS AND DISCUSSION

Operational Area

The land on which farmers perform agricultural activities regarding production is known as operational area, which is defined as, owned land plus leased-in minus leased out land. Operational area of the sample farmers depicted in Table 1 shows that the average operational holding was 15.06 hectares out of which on an average 8.12 hectares was owned by the sample farmers and 6.94 hectares was leased in. None of the sample farmers leased out his land in the study area. The average operational holding with the sample farmers was 15.06 hectares in which only 1.40 hectares was under chicory crop, which was about 9.30 percent to the average operational holding.

Cropping Pattern of the Sample Farmers

The cropping pattern indicates the extent of area grown of each crop as a percentage to the net cultivated 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 is important dimensions ought to be considered in evaluating land use pattern. It is evident from the Table 2 that net sown area was 15.06 hectares out of which paddy and wheat dominated the cropping pattern because these crops covered a significant area of 80.21 percent and 50.33 percent respectively. A sizeable proportion of *kharif* cropped area of 11.42 percent was covered by sugarcane, followed by other crops (5.18 percent) in the *kharif* season includes popular plantation and *kharif* fodder (3.19 percent). In *rabi* season, a sizeable proportion of cropped area was covered by winter maize. Sampled farmers assigned 9.30 percent of their net sown area to chicory crop followed by winter vegetables like tomato and beans (7.77 percent) and *rabi* fodder (3.19 percent).

Table 1. Operational area of the sample farmers, Punjab, 2014-15

Particulars	Area	Percentage
Owned land	8.12	53.92
Leased In	6.94	46.08
Leased Out	0.00	0.00
Average operational holding (hectares)	15.06	100.00
Average area under chicory crop	1.40	9.30*

This percent has been calculated from average operational holding size.

Table 2. Cropping pattern of the sample farmers, Punjab, 2014-15

(ha)

Crop	Area (hectares)	Percentage
Kharif		
Paddy	12.08	80.21
Sugarcane	1.72	11.42
Fodder	0.48	3.19
Others*	0.78	5.18
Kharif cropped area (NSA)	15.06	
Pre-*Rabi*		
Peas	1.90	5.37#
Potato	3.30	9.33#
Rabi		
Wheat	7.58	50.33
Sugar beet	0.18	1.19
Sugarcane	1.72	11.42
Winter maize	2.53	16.80
Fodder	0.48	3.19
Chicory	1.40	9.30
Others*	1.17	7.77
Rabi cropped area(NSA)	15.06	
Gross cropped area	35.35	

Others include area under popular in kharif season and in rabi season, it also includes vegetables like tomato and beans.
#percentages are calculated from net sown area.

Area under Chicory Cultivation

As already discussed; due to risk in adoption of new crop 56.67 percent of the sample farmers had brought 1hectare of land in the cultivation of chicory (Table 3). Out of the total sample,15 farmers had cultivated upto 2 hectares of land under chicory cultivation. To conclude 85

Table 3. Area under chicory crop among sample farmers, Punjab, 2014-15

Area of chicory (ha)	Number	Percentage
0-1	34	56.67
1-2	15	25.00
2-3	2	3.33
3-4	7	11.66
4-5	1	1.67
5-6	1	1.67
Total sample size	60	100.00

percent of the farmers cultivated upto 3hectares of land in chicory cultivation.

Input-use Pattern of Chicory Crop

An attempt has been made to examine human labour employment pattern in cultivation of chicory through tabular analysis and the same has been presented in Table 4. It was evident from the table that per hectare total labour-use was 893 hours which comprised of 809.41 hours of hired labour-use, 83.61 hours of family labour and attached labour. The hired labour-use accounted for the major use in the human labour employment pattern in the cultivation of chicory as most of the operations were done manually. Out of the hired labour-use, hoeing covered a major proportion (50.12 percent) followed by harvesting 49.14 percent respectively. Similarly, out of the total labour-use, harvesting accounted for 412.43 hours per hectare in which the share of hired labour was 397.78 hours. Thus, major share of human labour was used on two operations such as hoeing and harvesting, leaving 6 to 7 percent of labour-use on rest of operations. Total machine used is an addition of two components, that is, owned machine and hired machine. It was evident from the table that the total machine used was 88.58 hours per hectare which comprised of 88.03 hours of owned machine and 0.55 hours of hired machine. The total machine-use hours was found to be higher in irrigation (59.78 percent) followed by field preparation 13.04 percent. While examining the break-up of the total machine-use into different field operations, it has been found the largest proportions of the owned machine-use were on irrigation (52.95 hours). As all the farmers had their own tractors, and groundwater abstractions structures, that is, electric motors and submersible pumps, owned machine-use hours per hectare were higher than hired machine-use.

Use of Fertilizer

The dose of major and minor plant nutrients applied to the chicory crop by various sample farmers has been presented in Table 5. The study results revealed that on an average 342.70 kg of urea, 231.25 kg of DAP and 106.25 kg of MOP was used by chicory growers. These contain varying proportions of Nitrogen (N), Phosphorus (P) and Potash (K). It was observed that a major proportion (38.33 percent) of the farmers applied 200 to 250 kg of nitrogen per hectare followed by 33.34 percent farmers who applied 150 to 200 kg of nitrogen. Only 15 percent farmers applied 250 to 300 kg nitrogen per hectare. Thus, most of the sample farmers 43 out of 60 applied 150 to 250 kg of nitrogen per hectare. The use of phosphorus by different farmers varied from 50 to 200 kilograms per

Table 4. Input-use pattern of chicory crop among sample farmers, Punjab, 2014-15

(hours per ha)

Particulars	Family and attached labour	Hired labour	Total labour use	Owned machine	Hired machine	Total machine-use
Field preparation	14.43 (17.26)	0.30 (0.04)	14.73 (1.65)	11.25 (12.78)	0.30 (54.55)	11.55 (13.04)
Sowing	7.38 (8.83)	-	7.38 (0.83)	3.65 (4.15)	-	3.65 (4.12)
Fertilizer application	6.35 (7.59)	1.53 (0.19)	7.88 (0.88)	-	-	-
Plant protection	2.60 (3.11)	2.85 (0.35)	5.45 (0.61)	0.10 (0.11)	-	0.10 (0.11)
Hoeing	18.95 (22.67)	405.70 (50.12)	424.65 (47.55)	-	-	-
Irrigation	9.00 (10.76)	-	9.00 (1.01)	52.95 (60.15)	-	52.95 (59.78)
Harvesting	14.65 (17.52)	397.78 (49.14)	412.43 (46.18)	10.10 (11.47)	-	10.10 (11.40)
Marketing and Transportation	10.25 (12.26)	1.25 (0.16)	11.50 (1.29)	9.98 (11.34)	0.25 (45.45)	10.23 (11.55)
Total	83.61 (100.00)	809.41 (100.00)	893.02 (100.00)	88.03 (100.00)	0.55 (100.00)	88.58 (100.00)

Figures in parentheses are percent to the total.

Table 5. Use of fertilizer in chicory crop by sample farmers, Punjab, 2014-15

(Kg/ha)

Dose of fertilizer	Number of farmers	Percentage
Nitrogen		
100-150	8	13.33
150-200	20	33.34
200-250	23	38.33
250-300	9	15.00
Total sample size	60	100.00
Phosphorus		
50-100	11	18.33
100-150	47	78.34
150-200	2	3.33
Total sample size	60	100.00
Potash		
Nil	18	30.00
2.5-75	33	55.00
75-150	9	15.00
Total sample size	60	100.00
Sulphur		
Nil	49	81.67
2.5-25	8	13.33
25-50	3	5.00
Total sample size	60	100.00
Zinc		
Nil	57	95.00
0-12.5	3	5.00
Total sample size	60	100.00

hectare. Majority of the farmers (78.34 percent) applied 100 to 150 kg of phosphorus per hectare followed by 18.33 percent who applied 50 to 100 kg of phosphorus per hectare. Only two farmers applied 150 to 200 kg of phosphorus per hectare. The percentage of farmers who applied 2.5 to 75 kg of potash to the chicory crop was estimated to be 55 percent followed by 15 percent farmers who applied 75 to 150 kg of potash per hectare. Almost 82 percent and 95 percent of the farmers did not apply Sulphur and zinc respectively to the chicory crop.

Plant Protection

Weeds are the greatest enemies of the crop plants as they compete for everything the crop plant need. To raise a successful crop, it is, therefore, essential to eliminate the weeds as early as possible. The results presented in Table 6 exhibit the number of applications of weedicide spray by different sample farmers. The analysis revealed that 46.66percent of the farmers sprayed the crop once in the crop season and incurred an average cost of ₹1252.67, whereas 36.67 percent of the farmers did not went for weedicide spray. Nine farmers out of 60 (15 percent) of the sample farmers sprayed the crop twice and got highest average yield of 385 quintals per hectare with average

Table 6. Number of weedicide and insecticide sprays and hoeings in chicory crop by sample farmers, Punjab, 2014-15

(N=60)

Particulars	Number of farmers	Average yield (quintals per hectare)	Average cost of respective variables
Number of weedicide sprays			
Nil	22 (36.67)	312.38	-
1	28 (46.66)	353.75	1252.67
2	9 (15.00)	385.00	1811.12
3	1 (1.67)	375.00	3375.00
Number of insecticide sprays			
Nil	26 (43.33)	301.90	-
1	27 (45.00)	379.80	1707.22
2	6 (10.00)	343.75	3666.67
3	1 (1.67)	450.00	5250.00
Number of hoeings			
2	33 (55.00)	325.22	13639.75
3	23 (38.33)	366.63	22038.05
4	4 (6.67)	363.25	15000.00
Total sample size	60 (100.00)		

Figures in the parentheses indicate percentages of the total sample size.

cost ₹1811.12. Only one farmer out of 60 sprayed the weedicide thrice in one crop season on the chicory crop and he incurred ₹3375.00 as weedicide cost. The results depicted that nearly half of population of the farmers (45 percent) sprayed the crop once to control the insect-pests, whereas 10 percent of the farmers sprayed their crop twice. Only 1 farmer out of 60 sprayed the crop thrice. However, 43.33 percent of the farmers did not sprayed insecticide to the crop. The sample farmers who sprayed the crop once in the crop season got highest average yield of 379.80 quintals per hectare. On an average, single spray of insecticide cost ₹1707.22, two sprays cost ₹3666.67 whereas three sprays cost ₹5250.

To control the broadleaf weed infestation from the crop, hoeing was done by the sample farmers. The leaves of the chicory crop are broadly oblong, crowded at the base, forming a rosette arranged spirally on the stem. So, weedicide control was avoided to control the broadleaf

weeds. The results revealed that 55 percent of the farmers done hoeing two times in the crop season with an average cost of ₹13639.75 per hectare followed by 38.33 percent of the farmers who went for intercultural thrice in the crop season and got highest average yield of 366.63 quintals per hectare and their average cost was ₹22038.05. Only 4 farmers out of 60 made their fields free from weeds four times and got almost same average yield against three hoeings and the average cost incurred was ₹15000 due to family labour involved in the hoeing operations.

Operational Cost of Chicory Cultivation

All the input costs realized in chicory cultivation have been presented in the Table 7. The expenditure incurred on seeds, fertilizers, insecticides, weedicides, etc. and the payments given to casual labourers were added up to reach at the per hectare variable expenses incurred in chicory cultivation. The per hectare variable cost of cultivating chicory crop came out to be ₹59619.83. The results revealed that in the case of chicory cultivation the highest proportion of expenditure was spent on hired human labour, that is, more than half of the total expenditure (51.05 percent) mainly due to intensive use of labour in hoeing and harvesting of the crop. The cost incurred on human labour-use per hectare was ₹1777for family labour and ₹1367 for attached labour whereas it was ₹30434 on hired labour. The cost incurred on tractor use came out to be ₹9169 and ₹307per hectare on owned and hired components of tractor use respectively, thus constituting 15-16 percent of total operational cost. The cost of tractor-use includes the tractor oil consumption on cultivation, planking and sowing the field and also includes the tractor oil consumption in harvesting the crop if the farmers owned the tractor otherwise hired payment made by the farmer for preparing the field if the tractor was the hired one. The total number of irrigations in one crop season varied from three to ten depending upon the rainfall, climatic conditions, and type of soil. But at least 6-8 irrigations are required for proper maturing of crop. The average per hectare time required to irrigate chicory crop in one season by sample farmers came out to be 52.95 hours. The operational cost incurred on fertigation of crop came out to be ₹9496 per hectare which was 16.22 percent of the operational cost. The cost incurred on fertigation of the crop was much higher than the cost on plant protection chemicals. Thus the major cost component of chicory cultivation was human labour-use followed by fertilizers and tractor oil consumption with almost same extent. The average productivity of chicory came out to be 343.63 quintals per hectare. The average price realized was ₹335.25 per quintal. Thus, the gross returns came out to be ₹115202 per hectare. The per hectare variable cost incurred on chicory crop was ₹59620. The returns over variable cost came out to be ₹55582 per hectare. As the gross returns were higher than the operational cost of cultivating chicory, a benefit-cost ratio of 1.93 was realized.

Table 7. Operational cost of cultivating chicory by sample farmers in Punjab, 2014-15

(₹/ha)

Particulars	Quantity	Value
Seed (gm)	1145.83	2367.70
Fertilizer		
Urea (kg)	342.70	1850.63
DAP (kg)	231.25	5550.00
MOP (kg)	106.25	1785.00
Sulphur (kg)	2.08	122.93
Zinc (kg)	1.25	66.65
Gypsum (kg)	18.75	121.25
Irrigation		
Electric motor (hr)	52.95	-
Diesel engine	-	-
Agrochemical/weedicides	-	2134.93
Human labour		
Hired (hrs)	809.41	30433.90
Attached (hrs)	36.35	1366.78
Family (hrs)	47.26	1776.63
Tractor		
Own	35.08	9169.38
Hired	0.55	306.73
Total	-	57052.51
Interest @ 9 percent per half of the period of crop on operational cost	-	2567.35 (4.31)
Total variable cost	-	59619.86
Average yield (q)	343.63	115201.96
Average price	-	335.25
Gross returns	-	115201.96
Returns over variable cost	-	55582.10
Benefit-cost ratio	-	1.93

Gross Returns and Net Returns Earned by Farmers

A major proportion of sample farmers, that is, 33 out of total sample size of 60 got average net returns of ₹65409, which was more by the difference of ₹9827 from the average net returns of total chicory sample (Table 8); whereas only six farmers got average net returns of ₹106765 which was almost double than the average net returns of whole sample size. On the whole, 39 farmers got highest average net returns than the total sample's average net returns of chicory growers.

Factors Affecting Productivity

The Cobb-Douglas production function was employed to the data, Table 9 depicts the regression analysis results of the Cobb-Douglas production function fitted for yield. Output of the farm and resources per hectare for a particular crop on a farm is a function of different inputs used. The results brought out that in the

Table 8. Gross returns and net returns earned from chicory by sample farmers in Punjab, 2014-15

(₹/ha)

Gross returns	Number	Average gross returns	Average variable cost	Average net returns
37501-75000	8	64281.25	51482.00	12799.25
75001-125000	13	91860.57	58092.02	33768.55
125001-150000	33	128453.40	63044.67	65408.73
150001-187500	6	161494.17	54728.97	106765.20
Total sample size	60	115201.96	59619.86	55582.10

Table 9. Regression coefficients of Cobb-Douglas production function for chicory crop, Punjab, 2014-15

Variables	Unit	Estimated coefficients
Intercept	-	2.407^{NS} (1.547)
Seed	Kg	-0.375*** (0.124)
Urea	Kg	-0.113 (0.114)
Potash	Kg	-0.003 (0.012)
Crop duration	No. of days	1.033*** (0.283)
Weedicide cost	Rupee	0.014 (0.019)
Insecticide cost	Rupee	0.060** (0.031)
Family labour	Hours	0.078* (0.047)
Tractor use	Hours	0.457*** (0.142)
Coefficient of multiple determination (R^2)	-	0.604***
Adjusted coefficient of multiple determination	-	0.542

******, **, and * significant at 1, 5, and 10 percent level.***
Figures in parentheses indicates standard errors of regression coefficients.

case of chicory crop, the coefficient of multiple determination (R^2) came out to be 0.604 and was positively significant indicating that 60.4 percent of variation in the dependent variable was explained by the included explanatory variables in the model. The regression coefficients for crop duration and tractor use came out to be positively significant at one percent level indicating that if crop duration and tractor use is increased by one percent, the productivity of chicory would increase by 1.033 and 0.457 percent respectively. The regression coefficient for seed was negatively significant indicating that one percent increase in seed rate would decrease chicory productivity by 0.375 percent. The regression coefficient for family labour and insecticide cost was positively significant indicating that if family labour and insecticide cost is increased by one percent, the productivity of chicory would increase by 0.078 and 0.060 percent respectively.

Resource-use Efficiency

To evaluate the economic efficiency of resource-use in chicory cultivation, the ratio of marginal value products of input factors were compared with their respective prices. The basic criterion of an efficient resource-use is that ratio of marginal value product of a factor to the marginal factor cost is equal to one. A ratio of greater than one indicated that the returns could be increased by using more of that resource and ratio less than one indicated the unprofitable use of that resource which should be reduced to increase profit or gross margin. In order to examine the resource-use efficiency, the ratios of marginal value product of each resource with significant coefficient to the respective marginal cost were calculated and have been presented in Table 10. The results revealed that the ratio of MVP to MFC of insecticide cost, family labour and tractor use was found to positive and above unity, indicating that these resources were not being used optimally for chicory production by the farmers. The results showed that by spending an extra rupee on insecticide, family labour,and tractor use, the chicory farmers on an average would have been able to generate additional returns worth ₹5.99, ₹2.49, and ₹5.46 respectively. Whereas it was found that for seed the ratio of MVP to MFC was found to be less than unity, indicating the excessive use of seed in chicory cultivation. It is evident from the above discussion that the ratio of MVP of resources to their factor cost was different from unity, which suggests that there were inefficiencies in resource-use in chicory production, which needs to be corrected for by optimizing the allocation of these resources.

Source of Motivation of the Sample Farmers

The results revealed that the majority of the farmers (71.67 percent) got motivated for chicory cultivation

Table 10. Ratios of MVP to their factor costs in chicory cultivation in the study area, Punjab, 2014-15

Variables	Resource-use efficiency
Seed	-18.53
Insecticide cost	5.99
Tractor use	5.46
Family labour	2.49

Table 11. Source of inspiration for adopting chicory crop by the sample farmers in Punjab, 2014-15

Source of motivation	Number of farmers	Percent response
Field Surveyor	43	71.67
Fellow Farmers	11	18.33
Friends and relatives	6	10.00
Total Sample Size	60	100.00

Table 12. Distribution of growers according to yield against stated yield by contracting firms in Punjab, 2014-15

Category	Number of farmers	Percent response
Equal yield	3	5.00
Low yield	57	95.00

Stated yield as given by contracting agency was 500 quintals/hectare.

Table 13. Distribution of growers according to opinion regarding continuation of chicory along with reasons for continuing and discontinuing chicory cultivation in Punjab, 2014-15

Continuing cultivation	Number of farmers	Percent response
Yes	37	61.67
No	23	38.33
Total sample size	60	100.00
Reasons for continuing chicory cultivation(N=37)		
Yield up to expectation	11	29.73
High yield in future	26	70.27
Reasons for discontinuing chicory cultivation(N=23) (Multiple response)		
Late payment	15	65.22
Less yield	10	43.48
Shortage of labour	7	30.43
High distance from contracting firm	6	26.08

through field surveyors appointed by contracting firms followed by 28.33percent who went for the cultivation of this crop as they were inspired by fellow farmers, friends, and relatives. Therefore, surveyor emerged as one of the powerful sources of motivation for chicory cultivation (Table 11).

Yield status

A comparison was made between the stated yields by contracting agencies with the actual yield of sample farmers. The contracting firm claimed that the farmers will yield 500 quintals of chicory per hectare (Table 12). Three farmers out of 60, got yield equivalent to firms claimed yield. Remaining 57 farmers that is 95 percent farmers got lower yield against stated yield.

Opinion regarding Continuation of Chicory Cultivation

The farmers were asked whether they would continue the chicory cultivation in response to the question earlier asked. 37 farmers out of 60 (61.67 percent) farmers reported that they would be continuing the chicory cultivation in future. The rest of the 23 farmers out 60 (38.33 percent) of them refused to continue the chicory cultivation on their farms in future. They were unhappy with the contracting firms to whom they sold the crop as they were not given timely payment of the produce (Table 13). Out of 37 farmers who wanted to continue the chicory cultivation; 70.27 percent were of the view that they will continue its cultivation due to its better yield in the coming years. Only 11 farmers out of 60 (29.73 percent) put forth the reason of better yield than expected. Out of 23 farmers, 65.22 percent of the respondents do not want to continue the chicory cultivation due to the problem of late payment followed by 43.48percent farmers who told they got less yield of the crop. As much as 30.43percent of them told that they would discontinue chicory cultivation due to shortage of labour. Similarly, 26.08percent of them were of the view that they would discontinue chicory cultivation due to long distance to the processing unit.

CONCLUSIONS

The surveyor emerged as one of the powerful sources of motivation for chicory cultivation as 71.67 percent of the farmers started cultivation due to field surveyor appointed by processing units. Only 3 farmers got yield equivalent to firms claimed yield. About sixty-two percent farmers reported that they would be continuing the chicory cultivation in future. The rest of the farmers refused to continue chicory cultivation on their farms in future. Late payment, less yield, shortage of labour, and high transportation cost were the reasons for discontinuing chicory cultivation. The technical knowledge, know-how about the crop, practices which should be followed was all told by the representatives of processing units for popularizing chicory. As this crop had been newly introduced in the state for mixing in coffee powder, proper package of practices for this crop has not

been developed. Higher intensity of weeds, high labour needs, scarcity of labour and lack of technical knowledge were the main constraints in the production of chicory cultivation whereas, delayed payment, inadequate facilities of unloading the crop and high transportation cost were the main problems faced by the sample farmers in the marketing of chicory.

REFERENCES

Bais, H.P., & Ravishankar, G.A. (2001). Cichorium Intybus L-cultivation, processing, utility, value addition and biotechnology, with an emphasis on current status and future prospects Agriculture. *Journal of the Science of Food and Agriculture, 81,* 467-484.

Haque, E., Hashmi, A., & Ahmed, N. (2014, August 28). Chicory potential still waiting to tapped. *The Hindu*.

Kurian, B.K. (2007). *Management of marketing systems for perishable agricultural commodities in Kerala: Problems and prospects* (Doctoral Thesis). Mahatma Gandhi University, Kottayam, Kerala, India.

Sankhayan, P.L. (1988). *Introduction to the economics of agricultural production.* New Delhi: Prentice Hall of India Private Limited, Pp. 59-66.

Vaswani, L.K., Venkaakrishnan, V., Upadhyay, R. & Talati, J. (2003). *Agriculture-market linkages*: *Evaluating and evolving a conceptual framework in Indian context* (pp.72-99). NABARD Occasional Paper 28**.** Mumbai: NABARD.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 522-526
DOI: 10.5958/2322-0430.2018.00106.3

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Adoption of Entrepreneurial Activities of Members of PAU *Kisan Club* (Ladies Wing)

Rajwinder Kaur[1], Rupinder Kaur[2], and Parmveer Singh[3]*

[1]*Research Scholar,* [2]*Professor of Extension Education and* [3]*Senior Research Fellow, Department of Extension Education Punjab Agricultural University, Ludhiana-141004*

[*]*Correspondence author's email: rajext13@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-109* *Revision Accepted: March 10, 2018*

ABSTRACT

Rural women play a vital role in farm and home system. She contributes substantially in the physical aspects of farming, livestock management, post-harvest and allied activities. Women entrepreneurs are a significant part of the global expedition for sustained economic development and social progress. The present study was conducted at the main campus of Punjab Agricultural University, Ludhiana in Punjab (India) on 90 members of PAU Kisan Club (ladies wing) which were selected randomly from 150 active members. Data were collected through personal interview during monthly meetings of the PAU Kisan Club. Findings revealed that about 67 percent of respondents had adopted the enterprises at commercial level to get economic benefit and were motivated from members of PAU Kisan club and themselves. Majority of the respondents (53.33percent) were doing enterprise individually due to small-scale enterprises and also for personal economic gains. On the other hand 41.67 and 35.00 percent of the respondents have adopted the preservation of fruits and vegetables, and vegetable cultivation, respectively. Majority of the respondents (65.00 percent) had medium extent of adoption of entrepreneurial activities means these respondents have adopted 2-3 enterprises out of selected sixteen entrepreneurial activities. All the respondents were selling their produce at household level. But out of that about 53.00 percent, respondents were selling their produce at Kisan Mela also. It was noticed that 66.67 and 58.33 percent of the respondents faced problem regarding frequent power cut and unable to purchase modern machinery due to inadequate capital.

Keywords

Adoption, enterprise, entrepreneurship, problems, women entrepreneur.

JEL Codes

C81, Q16.

INTRODUCTION

Rural women play a productive role in farming system. They were play crucial to sustenance of the rural economy. Women entrepreneurs are a significant part of the global expedition for sustained economic development and social progress. Due to the growing industrialization, urbanization, social legislation and along with the spread of higher education and awareness, the emergences of women-owned businesses are highly increasing in the economies of almost all countries. In former days, for women there were 3 Ks-Kitchen, Kids, Knitting, then came 3 Ps-Powder, Papad, Pickles and now at present, there are 4 Es-Electricity, Electronics, Energy, Engineering. Indian women had undergone a long way and are becoming increasingly visible and successful in all spheres and have shifted from kitchen to higher level of professional activities.

The term entrepreneur is derived from the French word "Entreprendre" which mean "to undertake". In the early 16th century, it was applied to those engaged in military expedition. In 17th century, it was extended to cover civil engineering activities. According to Schumpter (1966), the entrepreneur is a dynamic agent of change or the catalyst who transforms increasing physical, natural and human resources in a corresponding production possibility. According to Pareek & Nandkarni (1978), an entrepreneur is one who initiates and establishes an economic activity or enterprise. Mukherjee (2010) draws the picture of an entrepreneur as a person who assumes the risk associated with uncertainty, an adventurer who undertakes risks, brings together the capital and labour required for the work, an innovator, a

decision maker, an economic leader, a manager or a superintendent, an organizer and coordinator of economic resources, an owner, a contractor, a referee and a locator of resources for alternative uses. Being entrepreneurial involves combining personal characteristics and financial means and resources within an environment to set up a business

Entrepreneur	Entrepreneurship	Enterprise
↕	↕	↕
Person	Process/ Philosophy	Objective

Entrepreneurship on small scale is the only solution to the problems of unemployment and proper utilization of both human and non-human resources and improving the living conditions of the poor masses. According to Kuratko & Richard (2001), entrepreneurship is the dynamic process of creating incremental wealth. This wealth is created by individuals who take the major risks in terms of equity, time and career commitment of providing value to some product or services the product or service itself may or may not be new or unique but value must somehow be infused by the entrepreneur by securing and allocating the necessary skill and resources. In other words, it is the application of energy for initiating and building an enterprise.

Women contribute substantially in the physical aspects of farming, livestock management, post-harvest and allied activities. Her direct and indirect contribution at the farm and home level along with livestock management operation has not only helped to save but also led to increase in family income. Women are primarily engaged in agricultural enterprises dairy, bee-keeping, jam/jelly/pickles preparation, poultry, basket/mat preparation, and mushroom, vegetables cultivation. Non-agricultural activities are stitching, embroidery, soft toy making, detergent, and soap making and papad/badi preparation, etc. Female entrepreneurship helps the process of economic development, creation of new jobs, and cut back unemployment in rural areas. Godawat (2010) studied the adoption of different enterprises by the women. About 32 percent women had adopted various enterprises viz. Cutting and Tailoring, Fruits and Vegetable preservation, Embroidery and Needlework and Food processing. Huria (2013) observed that women are very good entrepreneurs, and prefer to choose the same as they can maintain work-life balance. Even though we have many successful women entre-preneurs in our country, but as we have a male-dominated culture there are many challenges which women entrepreneurs face from family and society. Dayya *et al*. (2016) studied the adoption of entrepreneurial activities by rural women. It was found that 34 percent respondents have adopted different enterprises. Out of the total adopters, 70 percent women adopted goat rearing enterprise, stitching enterprise (48 percent), vegetable production and flower cultivation enterprises were adopted by the same percentage (37.5.). Nearly one fourth (23percent) of the respondents adopted dairy enterprise whereas, beauty parlour enterprise was adopt by less than one fourth (20percent) of the respondents.

MATERIAL AND METHODS

The study was conducted at the main campus of Punjab Agricultural University, Ludhiana in Punjab State in 2014-2016. A list of members of PAU *Kisan Club* (ladies wing) was procured from *Kairon Kisan Ghar*, Punjab Agricultural University, Ludhiana, Punjab (India). Out of 150 active members, 90 members were selected randomly who attended the club monthly meetings regularly (60 percent meetings per year). Data were collected through personal interview method during monthly meetings of the PAU *Kisan Club* (ladies wing). Data were analyzed with the help of frequency distribution, percentage, and Cumulative frequency cube root method.

Extent of Adoption

Extent of adoption refers to the number of entrepreneurial activities adopted by lady members of PAU *Kisan Club*. The entrepreneurial activities identified are vegetable cultivation , mushroom cultivation, preservation of fruits and vegetables, value addition to milk , processing of Agri produce (*Haldi, besan, sevian* making etc.), artificial jewellery making, beekeeping, dairy farming , preparation of eco-friendly cleaning agents, fabric painting, stitching , beauty parlour , cooking classes , tiffin system , tuitions and *pakhing* and *dari making.*

$$\text{Extent of adoption} = \frac{\text{Total adopted activities}}{\text{Total entrepreneurial activities}} \times 100$$

The extent of adoption was measured by using Cumulative frequency cube root method.

Problems

These referred to the difficulties being faced by the members of PAU *Kisan Club* (ladies wing) in the adoption of entrepreneurial activities.

Cumulative Frequency Cube Root Method

Singh (1975) proposed a cumulative cube root rule to obtain approximately optimum strata boundaries for the proportional allocation method. The Cumulative Frequency Cube root method was employed to classify the respondents into different categories with probability proportional to the number of respondents in each category:

$$Si = L_i + \frac{N/3 - Cf_{i-1}}{F} \times h$$

Where:

L_i=Lower limit of the class

Cf_{i-1}=Cf of class proceeding to the quarantine class

f=frequency for quarantine class in $3\sqrt{F}$ column

h=width of class or interval

RESULTS AND DISCUSSION

Level of Entrepreneurship

Data presented in (Table 1) showed that majority of the respondents about 67.00 percent had adopted the enterprises at commercial level to get economic benefit. They were selling their produce at various places like household level, *Kisan Mela*, local markets, *ApniMandi*, *SarasMela* and International Trade Fair at *PragatiMaidan* in New Delhi. On the other hand 33.33percent of the respondents were making the products for home/family consumption only. They were not selling their produce in market for generating income.

Sources of Motivation

The perusal of Table 2 revealed that majority of respondents (88.33 and 86.67 percent) were motivated by members of the PAU *Kisan Club* and self-motivated for establishment of enterprise respectively as localities sources respectively. But 85.00 and 38.33 percent of respondents were motivated from *Kisan Mela* and television respectively as cosmopolite's sources respectively. The findings get support from Maheswari & Chitra (2013).

Motive of Starting the Enterprise

The results presented in Table 3 showed that all the respondents have started the enterprise for economic benefit while 91.67, 58.33 and 36.67percent respondents started enterprise for utilization of leisure time, utilization of skill and enhancement of social status respectively. The findings of study are in track with Dayya *et al*. (2016) they also concluded that most important reason for adoption of an enterprise was to earn money.

Ownership Status of Enterprise

It is evident from Table 4 that 53.33 percent of the respondents had started their enterprises individually. About 32.00 percent respondents who were part of self-help groups and only 15.00 percent had started their enterprises with partnership concern. Due to small-scale enterprises and also for personal economic gains, majority of the respondents were doing enterprise individually.

Adoption of Each Enterprise

The results presented in Table 5 revealed that 41.67 and 35.00 percent respondents have adopted the enterprises, that is, preservation of fruits and vegetables and vegetable cultivation respectively. But 28.33, 25.00 and 16.67 percent respondents have adopted dairy farming, processing of agri-produce (haldi, basen, sevian making, etc.) and preparation of eco-friendly cleaning agents respectively. While 15.00percent of the respondents have adopted both value addition to milk and stitching. About 14.00percent of the respondents have adopted both mushroom cultivation and Beekeeping enterprise respectively. Only 8.33 percent respondents have adopted both artificial jewellery and fabric painting.These findings were almost similar with the Godawat (2010) who reported that 40.00 percent respondents have adopted the enterprises, that is, fruits and vegetable preservation.

Table 1. Distribution of the respondents according to level of entrepreneurship

(n=90)

Level of entrepreneurship	Frequency	Percentage
Domestic level	30	33.33
Commercial level	60	66.67

Table 2. Distribution of the respondents according to their sources of motivation to start the enterprise

(n=60)

Sources of motivation	Frequency	Percentage*
Localities sources		
Self-motivated	52	86.67
Family members	43	71.67
PAU Staff	50	83.33
Extension Personnel of KVK	33	55.00
Members of the PAU *Kisan Club*	53	88.33
Friends/Neighbourer/Relatives	43	71.67
Successful entrepreneur/ Progressives farm women	35	58.33
Cosmopolites sources		
Magazines	21	35.00
Newspapers	18	30.00
Kisan Mela	51	85.00
TV	23	38.33
Radio	14	23.33

Percent exceeds 100 due to multiple responses.

Table 3. Distribution of the respondents according to their motive of starting the enterprise

(n=60)

Motive	Frequency	Percentage*
Utilization of leisure time	55	91.67
Economic benefit	60	100.00
Utilization of skill	35	58.33
Enhancement of social status	22	36.67

Percent exceeds 100 due to multiple responses.

Table 4. Distribution of respondents according to ownership status of enterprise

(n=60)

Ownership status	Frequency	Percentage
Individual concern	32	53.33
Partnership concern	9	15.00
Self help group	19	31.67

Extent of Adoption of Entrepreneurial Activities

Extent of adoption was measured in terms of number of entrepreneurial activities adopted by lady members of PAU *Kisan Club*. It was categorized into three categories

low, medium, high by using cumulative frequency cube root method.

The perusal of Table 6 revealed that majority of the respondents (65.00 percent) had medium extent of adoption of entrepreneurial activities means these respondents had adopted 2-3 enterprises while about 22.00 percent of the respondents had low extent of adoption of entrepreneurial activities means these respondents had adopted only one enterprise. Only 13.33 percent of the respondents had high extent of adoption of entrepreneurial activities means these respondents had adopted 4–5 enterprises out of sixteen selected entrepreneurial activities.

Marketing of Produce

It is evident from Table 7 that percent of the respondents were selling their produce at household level. But out of that about 53.00percent, respondents were selling their produce at *Kisan Mela* also. While 31.67, 25.00 and 16.67percent respondents have also sold their produce at *Saras Mela*, local markets, and *ApniMandi* respectively. Only 10.00 percent respondents sold their produce at International Trade Fair at *PragatiMaidan* in New Delhi.

Problems Faced by the Respondents Regarding Their Enterprises

The perusal of Table 8 revealed that 66.67 and 58.33percent respondents faced problem regarding frequent power cut and unable to purchase modern machinery due to inadequate capital. The results are consistent with the Aslam *et al.* (2013) who found that electricity shortage and lack of working capital were the problems related to their enterprises in Pakistan.

While 35.00, 30.00 and 28.33 percent respondents faced problem of high cost of inputs, uncertainty of weather and attack of insect/pest disease respectively. Only a negligible proportion 8.33percent of respondents faced the problem of lack of transportation facilities.

Table 5. Distribution of the respondents according to adoption of each enterprise

(n=60)

Enterprise/Activities	Frequency	Percentage*
Vegetable cultivation	21	35.00
Mushroom cultivation	8	13.33
Preservation of fruits and vegetables	25	41.67
Dairy farming	17	28.33
Value addition to milk	9	15.00
Beekeeping	8	13.33
Processing of agri-produce (haldi, besan, sevian making, etc.)	15	25.00
Artificial jewellery	5	8.33
Preparation of eco-friendly cleaning agents	10	16.67
Fabric painting	5	8.33
Stitching	9	15.00
Beauty parlour	4	6.67
Cooking classes	2	3.33
Tiffin system	1	1.67
Tuitions	1	1.67
Pakhi and *Dari* making	1	1.67

Percent exceeds 100 due to multiple responses.

Table 6. Distribution of respondents according to extent of adoption of entrepreneurial activities

(n=60)

Extent of adoption (percent)	No. of activities	Frequency	Percentage
Low (<11)	1	13	21.67
Medium (12–22)	2-3	39	65.00
High (23 – 33)	4–5	8	13.33

Total entrepreneurial activities=16.

Table 7. Distribution of respondents according to places of marketing of their produce

(n=60)

Marketing of produce	Frequency	Percentage*
Household level	60	100.00
Kisan Mela	32	53.33
Local markets	15	25.00
Apnimandi	10	16.67
Saras Mela	19	31.67
International Trade Fair at *Pargatimaidan* in New Delhi	6	10.00

Percent exceeds 100 due to multiple responses.

Table 8. Distribution of respondents according to the problems faced by them regarding their enterprise

(n=60)

Problems	Frequency	Percentage*
Inability to purchase modern machinery due to inadequate capital	35	58.33
Frequent power cut	40	66.67
Lack of financing agencies	7	11.67
Difficulty in getting loan	7	11.67
High cost of inputs	21	35.00
Uncertainty of weather	18	30.00
Attack of insect pests and diseases	17	28.33
Lack of transportation facilities	5	8.33

Percent exceeds 100 due to multiple responses.

CONCLUSIONS

Rural women perform variety of operations in their farm and home. From the above study, it can be concluded that the permanent solution of rural poverty and

unemployment is the promotion of entrepreneurship among rural masses. This is more beneficial for women in rural areas as it enable them to add to the family income. Entrepreneurial development among rural women not only helps to enhance their person capabilities but also raise the status of women in the family and society.

REFERENCES

Aslam, S., Latif, M., & Aslam, M. (2013). Problems faced by women entrepreneurs and their impact on working efficiency of women in Pakistan. *Journal of Scientific Research, 8*, 1204-1215.

Dayya, P., Bsnsal, V., & Solanki, D. (2016). Adoption of entrepreneurial activities by rural women. *Journal of Multidisciplinary Advance Research, 5*, 6-9.

Godawat, A. (2010). Adoption of entrepreneurial activities envisaged under Rajasthan mission on livelihood by women. *Rajasthan Journal of Extension Education, 18*, 191-193.

Huria, N. (2013). Changing image of women entrepreneurship: A review of 4 p's (Prospects, Problems, Perception, Performance). *Management 2*(12), 167-171.

Kuratko, D.F., & Richard, M.H. (2001). *Entrepreneurship-A contemporary approach* (5th ed.). New York, USA: Harcourt College Publishers.

Maheswari, B., & Chitra, S. (2013). Problems and challenges faced by women entrepreneurs. *International Journal of Entrepreneurship and Business Environment Perspectives, 2*, 549-551.

Mukherjee, S. (2010). Profiling the urban women micro-entrepreneurs in India. *The IUP Journal of Entrepreneurship Development, 3*, 243-256.

Pareek, U., & Nandkarni, M.S. (1978). *Manual on summer school: Pedagogy of entrepreneur development for women* (pp 95). Hisar: CCSHAU.

Schumpeter, J.A. (1966). *A theory of economic development: An inquiry into profits, capital, credit, interest and the business cycle* (pp. 255). New York: Oxford Press.

Singh, R. (1975). An optimum stratification for proportional allocation. *Sankhya, 37*, 109-115.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 527-534
DOI: 10.5958/2322-0430.2018.00107.5

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Comparative Performance of Mahatma Gandhi National Rural Employment Guarantee Scheme of Rural Women Labour Participants in Punjab and Karnataka: Analysis and their Problems and Suggestions

Syed Rizwan Ahmed[1], Sanjay Kumar[2], Jasdev Singh[2] and Murtuza Khan[3]*

[1]Research Scholar and [2]Agricultural Economists, Department of Economics and Sociology*
Punjab Agricultural University, Ludhiana-141004
[3]Professor and Head, Department of Agricultural Economics, GKVK, UAS, Bengaluru

[*]Corresponding author's email: syedrizwan-aes@pau.edu

Received: December 31, 2017 *Manuscript Number: NS-18-111* *Revision Accepted: February 25, 2018*

ABSTRACT

Mahatma Gandhi National Rural Employment Guarantee Scheme envisages livelihood and social security by providing at least 100 to 150 days of guaranteed wage employment to every rural Households whose adult members volunteer to do unskilled manual work. The present study helps us to compare both in terms of participation and efficiency. Multistage random sampling was used in household-level data on Two Indian states encompassing over 6 districts and 300 sampled rural women labourers as respondents during 2016-17. The study evidenced that in both, the states majority of assets created was related to road development, land development, and rural sanitation. In Punjab, Due to lack of funds and insufficient balances in respective villages with their allotted funds some of the works was not completed and it was observed that a project approved by gram panchayat was ongoing works that will take time to complete but in Karnataka, the scheme was performing better with efficient utilization of funds and resources. Major problems faced by rural women labourers in Punjab are due to illiteracy, they feel difficulty in filling form for further registration process, untimely measurement of work, lack of adequate, and irregularity in work, harassment during work, and in Karnataka, the major problems faced by rural women labourers was mostly related to low technical unskilled work, no resting place, lack of child care facility at MGNREGS working site and corruption practices from the part of officers/ officials was highly observed. Suggestions given by the majority of rural women labour participant in scheme in the context of further improvement are as follows regular work should be given, minimum 100 days employment should be given, wage rate should be increased, awareness among the rural women should be increased, skill work should be provided, procedure should be simplified, social prohibition should be reduced etc. These findings are therefore a pointer to the fact that a public work programme such as MGNREGS plays an important role in influencing and improving standard of life of rural women laborers who are desirable and they plays important role for sustainable rural development.

Keywords
Employment, labour, MGNREGS, rural, women.

JEL Codes
C82, E24, J21, Y10.

INTRODUCTION

The 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 (Ministry of Rural Development, 2014).

In Punjab, the scheme was implemented in a phased manner. In the first phase, only Hoshiarpur district was selected with effect from February 2, 2006, and in its second phase extended subsequently to additional 3 districts like Nawanshahr, Jalandhar, Amritsar with effect from April 1st, 2007 and May 15th, 2007. In the third phase the rest of the districts were covered under the Act from April 1st, 2008 like Moga, Gurdaspur, Fatehgarh Sahib,

Bathinda, Faridkot, Ludhiana, and others, in Karnataka also the scheme was implemented in a phased manner. In the first phase - Most backward 5 Districts was selected, Bidar, Gulbarga, Chitradurga, Davangere, and Raichur with effect from Feb 2, 2006, and in its second phase extended subsequently to additional 6 districts with effect from April 1st, 2007 and May, 2007, Bellary, Hassan, Chitradurga, Belgaum, Shimoga, Kodagu and in the third phase-the rest of the districts were covered under the Act from April 1st, 2008, some of them are Chamrajanagar, Mandya, Udupi, Koppal, Tumkur, Kolar, Mysore, Gadag, Dakshina Kannada and others (Ministry of Rural Development, 2011).

As per Act Women's should access to at least one-third of the share of total employment created is a special entitlement under MGNREGA. However, there are several factors like socio-cultural, economic and demographic, psychological factors which affect women's participation in work. After a decade of implementation of scheme, there was a wide variation in the female work participation rates across the country because of socio-cultural reasons present in different states of India (Ministry of Rural Development, 2015).

At present central budget 2017-18 the highest ever allocation of INR 48000 crore has been made and the performance of the scheme has shown a consistent improvement almost in time of decade. The number of households who was provided employment under MGNREGS has increased rapidly which shows a wider efficiency in coverage of the scheme. The other important points to be noticed are the increasing participation of women, the increasing person-days employment per household and the average wage per person-days. All these indicate that substantial income is being provided to the households working under the Scheme. Wage-earners are the main focus of this Scheme and it has enormous potential to uplift the socio-economic status of the rural poor who are mainly landless agricultural laborers and marginal and small women farmers. Substantial increase in income will obviously lead to a better standard of living. The participation in MGNREGS gave them more confidence as they earned their own livelihood and also had opportunity to interact external and internal environmental work conditions with other women as groups in the society. Thus MGNREGS has been successful in providing all the components that pave the way for empowering women (Vanitha, 2010). However, one can easily understand that the implementation of the scheme is not uniform across the state. Hence in this background that the present paper investigates with the broad intention of finding the answer to the specific objectives like to evaluate and examine the socio-economic conditions of rural women labors with their comparative performance and their problems with suggestions are encountered from Punjab and Karnataka.

METHODOLOGY

Presently MGNREGS has been implemented in all the states and union territories of India. The study is based on primary as well as secondary data. The primary data has been collected from all over Punjab and Karnataka by phase wise implementation which was presented in Table 1 and 2. Total 300 respondents was enumerated in all the 12 selected villages was done covering both Punjab and Karnataka households. A pre-tested and well-designed questionnaire has been used to collect the information regarding the socio-economic conditions assets creation and constraints and suggestion for further improvement of scheme from selected households in respective villages. The secondary data has been collected from various published and unpublished sources like DMU report available at official website of MGNREGA (Ministry of Rural Development, 2017). The information will be subjected to various statistical tools to draw meaningful conclusions. The reference period of study is 2016-17.

RESULTS AND DISCUSSION

Socio-Economic Profile of the Sampled Beneficiaries

Age wise distribution of the respondents

The perusal of Table 3 given that in Punjab about 36 percent of the respondents were in the age group of 38 to

Table 1. Sample distribution from Punjab state

Phase-wise	Punjab			
	District	Block	Village	No. of Respondent
Phase I	Hoshiarpur	Hoshiarpur II	Mona- Kalan	25
			Patti	25
Total	1	1	2	50
Phase II	Nawashahar	Balachaur	Dr. Ambedkar Nagar	25
			JatMajri	25
Total	1	1	2	50
Phase III	Ludhiana	Ludhiana I	Ayali Kalan	25
			Jhammat	25
Total	1	1	2	50
Grand Total	3	3	6	150

47 years while 44.7 percent of the respondents were in the age groups of 28-37 years are present in Karnataka respectively. The overall 37 percent of age of the respondents came out to be 28 to 37 years in both states.

Religion-wise distribution of the respondents

The study observed that majority (50.67 percent) of the respondents was the Sikhs, 49.33 percent were the Hindus, and none of them were the Muslims and the Christians are present in Punjab respectively. In Karnataka, 84.67 percent of the respondents under study were the Hindus, and very meager percent of respondents were the Muslims and Christians respectively (Table 3).

Caste wise distribution of the respondents

The results registered that overall in Punjab, half of the respondents (51.3 percent) under study were from scheduled castes and 38 percent from backward classes. As for as the Karnataka caste distribution was concerned, it was found that the proportion of the respondents belonging to other backward classes was about to be 30 percent, while the respondents belonging to scheduled castes were 44 percent and scheduled tribes constituted about 23 percent, respectively. It was found that majority of workers constituted around 47.65 percent as respondents in both states belonged to scheduled castes (Table 3).

Marital Status of the respondents

It was found from the study that that overall 78 and 74 percent of the respondents was married, 3.3 and 14.0 percent was unmarried, 13.3 and 8.0 percent were widows while 5.3 and 4 percent were divorced in Punjab and Karnataka respectively.

Education wise distribution level of the respondents

The educational level of the respondents taken under the study was examined and that the proportion of the respondents like majority (53.3 percent) were illiterate in Punjab and in Karnataka, 45.3 percent and 26.7 percent of the respondent had studied up to the primary level and middle-level schools respectively (Table 3).

Distribution of annual family income of the respondent

It was generated from the study that overall a low

Table 3. Socio-Economic Profile of the sampled rural women labor participants

(Percent)

Particulars	Punjab	Karnataka	Overall
Age-wise distribution (Years)			
18-27	6.7	20.7	13.7
28-37	29.3	44.7	37.0
38-47	36.7	26.7	31.7
48-57	20.7	7.3	14.0
58-67	4.7	0.7	2.7
68-77	2.0	0.0	1.0
Religion			
Hindu	49.33	84.67	67.0
Christian	-	5.33	5.33
Muslim	-	10.00	10.0
Sikh	50.67	-	50.67
Caste wise distribution			
SC	51.3	44.0	47.65
ST	-	22.7	22.7
OBC	38.0	30.0	34.0
General	10.7	3.3	7.0
Marital status			
Unmarried	3.3	14.0	8.65
Married	78.0	74.0	76.0
Widow	13.3	8.0	10.65
Divorced	5.3	4.0	4.65
Educational level			
Illiterate	53.3	14.7	34.0
Primary	22.0	45.3	33.65
Middle	17.3	26.7	22.0
Secondary	6.0	9.3	7.65
Undergraduate	1.3	4.0	2.65
Annual family income (₹)			
30000-40000	21.3	40.0	30.65
40000-50000	55.3	36.7	46.0
50000-60000	19.3	20.7	20.0
60000-70000	4.0	2.7	3.35
Total	**100.0**	**100.0**	**100.0**

Source: Survey data, 2016-17.

Table 2. Sample distribution from Karnataka state

Phase-wise	Karnataka			
	District	Block	Village	No. of respondent
Phase I	Bellary	Hospet	Malapanagudi	25
			Hampi	25
Total	1	1	2	50
Phase II	Chitradurga	Hiriyur	Muskal	25
			Babbur	25
Total	1	1	2	50
Phase III	Kolar	Kolar I	Huttur	25
			Sugatur	25
Total	1	1	2	50
Grand Total	3	3	6	150

proportion of the respondents, 4 and 2.7 percent had their family income greater than ₹60000 per annum. The majority (55.3 percent) had their family income between ₹40000-₹50000 per annum (Table 3). About 40 percent, of the respondents, had their family income of more than ₹30000 per annum in Karnataka respectively.

At present in Punjab, the total number of 22 districts, 148 blocks and 13,079 number of Gram panchayat are present and in Karnataka the total number of 30 districts, 176 blocks and 6,024 number of Gram panchayat, are present, then overall at all India level, the total number of 685 districts, 6865 blocks and 2,62,704 number of Gram panchayat are present in the scheme (Ministry of Rural Development, 2017) .

From the Table 4, it shows that during 2016-17, total numbers of job card issued was about Punjab (14.85), Karnataka (54.56), all India (12.61) crores, the total person-days generated was about Punjab (157.74), Karnataka (914.12), all India (235.75) crores, women percentage was about Punjab (59.97), Karnataka (47.21), all India (56.15) percent, and average wage rate per day per person was about Punjab (₹214.02), Karnataka (₹223.38), all India (₹161.65), But the share of SC's and ST's percentage in terms of total person-days was remains same over a period of time. Since the scheme inceptions, 40,787.19 crores wages has been released with total expenditure of about 433125.98 crores, while expenditure on agriculture and agricultural allied works was also increased to Punjab (46.62), Karnataka (77.09), all India (65.86) percent has been made under the scheme, with the number of works ongoing was about Punjab (0.24), Karnataka (6.43), all India (102.41), Lakhs over completed works was about in Punjab (19,496) Karnataka (3,47,340) and all India (64.77), lakhs respectively.

From the survey data relating to various types of works allotted to women laborers in the rural areas of Punjab under the scheme is highlighted in Table 5. The perusal of Table 5 clearly shows that Major assets created which are related about Renovation of traditional water bodies Punjab (48.67), Karnataka (61.33) percent, Road development was about Punjab (74.67), Karnataka (94.67) percent, Land development was about Punjab (63.33), Karnataka (92.00) percent, Flood control was about Punjab (18.67), Karnataka (38.00) percent, Water conservation, and water harvesting was about Punjab (28.67), Karnataka (72.00) percent Check dam was about Punjab (10.00), Karnataka (73.33) percent, Farm pond was about Punjab (9.33), Karnataka (70.00) percent, Irrigation/ canal works Punjab (73.33), Karnataka (50.67)percent, Planting was about Punjab (92.67), Karnataka (90.00) percent, Digging of village ponds was about Punjab (32.67), Karnataka (58.67)percent, Rural sanitation was about Punjab (92.00), Karnataka (93.33) percent, Pavement of streets constitutes about Punjab (92.67), Karnataka (43.33) percent was taken together, however, the central and state government has enlisted various works under this scheme but the implementation of these works varies with the socio-economic, geographical psychological conditions of the women labourers who are constantly working in their respective state. In both the states majority of works related to road development, land development, and rural sanitation. Majority of the respective gram panchayat was urged to take-ups works such as repairs and cleaning of streets, construction of new buildings and toilets for schools and panchayat bhawans, community crematorium and sewage was enlisted under the scheme for overall development of the villages. Due to lack of funds and insufficient balances in respective villages with their allotted funds, some of the works was not completed and

Table 4. An overview of the descriptive performance of MGNREGS in Punjab and Karnataka, 2016-17

Particulars	Punjab	Karnataka	All India
Total No. of job cards issued (Crores)	14.85	54.56	12.61
Total No. of workers (Crores)	23.83	134.84	25.13
Persondays generated so far (Crores)	157.74	914.12	235.7539
SC person-days percent as of total person-days	75.63	16.05	21.32
ST person-days percent as of total person-days	0.02	9.23	17.6
Women person-days out of total (percent)	59.97	47.21	56.15
Average days of employment provided per Household	29.41	50.27	46.01
Average wage rate per day per person (₹)	214.02	223.38	161.65
Total no of HHs completed 100 days of wage employment	3,511	1,96,457	39,91,932
Total households worked (Crores)	5.36	18.18	5.1242
Number of ongoing works (Lakhs)	0.24	6.43	102.41
Number of completed works (Lakhs)	19,496	3,47,340	64.77
Percent of NRM Exp.(Public + Individual)	46.48	63.16	60.01
Percent of category B works(Community + Individual)	0.51	71.75	47.05
Percent of expenditure on agriculture and agriculture aAllied Works	46.62	77.09	65.86

Source: Ministry of Rural Development, 2017.

it was observed that a project approved by gram panchayat was ongoing works that will take time to complete. This findings are inconsonance with the recently reported by Singh *et al*. (2016).

The results illustrated in Table 6 reflects the problems faced by women labors related to supervisor (mate) and registration process was revealed that around 83.3 and 66.67 percent of workers in both states narrated the problem of registration occurs due to illiteracy, feel difficulty in filling form to get their job cards.

The data provided in the Table 7, precisely and clearly evidenced that there was a wide variation in response

Table 5. Type of assets created towards workingin MGNREGS by rural women labor participants

(Percent)

Nature of work	Punjab		Karnataka		Overall	
	Yes	No	Yes	No	Yes	No
Renovation of traditional water bodies	48.67	51.33	61.33	38.67	55.00	45.00
Road development	74.67	25.33	94.67	5.33	84.67	15.33
Land development	63.33	36.67	92.00	8.00	77.67	22.33
Flood control	18.67	81.33	38.00	62.00	28.33	71.67
Water conservation and water harvesting	28.67	71.33	72.00	28.00	50.33	49.67
Check dam	10.00	90.00	73.33	26.67	41.67	58.33
Farm pond	9.33	90.67	70.00	30.00	39.67	60.33
Irrigation/ canal works	73.33	26.67	50.67	49.33	62.00	38.00
Planting	92.67	7.33	90.00	10.00	91.33	8.67
Digging of village ponds	92.67	7.33	58.67	41.33	75.67	24.33
Rural sanitation	92.00	8.00	93.33	6.67	92.67	7.33
Pavement of streets	92.67	7.33	43.33	56.67	68.00	32.00
others	94.00	6.00	5.33	94.67	49.67	50.33

Source: Survey data, 2016-17.

Table 6. Constraints faced by the rural women labor participant in scheme related to supervisor and registration process

(Percent)

Problems	Punjab		Karnataka		Overall	
	Yes	No	Yes	No	Yes	No
Supervisor is not present at work place	10.0	90.0	38.67	61.33	24.33	75.67
Undesirable behavior of supervisor	10.0	90.0	30.00	70.00	20.00	80.00
Due to illiteracy, feel difficulty in filling form	83.3	16.7	66.67	33.33	75.00	25.00
Complex procedure of registration	68.0	32.0	52.67	47.33	60.33	39.67

Source: Survey data, 2016-17.

Table 7. Constraints faced by the rural women labor participants in scheme related to work

(Percent)

Problems	Punjab		Karnataka		Overall	
	Yes	No	Yes	No	Yes	No
Untimely measurement of work	72.67	27.33	82.67	17.33	77.67	22.33
Lack of adequate work	88.00	12.00	70.00	30.00	79.00	21.00
Irregularity in work	27.33	72.67	65.33	34.67	46.33	53.67
Harassment during work	16.67	83.33	54.00	46.00	35.33	64.67
Low technical unskilled work	98.00	2.00	54.67	45.33	76.33	23.67
Exploitation of workers by mate	13.33	86.67	42.00	58.00	27.67	72.33
Work place at a far distance place	0.00	100.00	41.33	58.67	20.67	79.33
MGNREGS work is more laborious and hard for women	68.67	31.33	38.00	62.00	53.33	46.67
Any panchayat member refuse to entertain your application for work	10.67	89.33	47.33	52.67	29.00	71.00
Are the works completed under the scheme used for the village development	92.67	7.33	68.67	31.33	80.67	19.33

Source: Survey data, 2016-17.

related to work but in Punjab, about 98.00 percent of problems exists related to low technical unskilled work given to the rural women laborers. In Karnataka data predicted 82.67 percent of rural women laborers faced problems of untimely measurement of work in their respective villages.

From the Table 8, appeared that in Punjab about 99.33 percent told around wage rates was the same for males and females and 90.67 percent also told very low wage rate was getting to rural women laborers. In Karnataka all most all workers 100.00 percent told that wage rates was the same for males and females and 89.33 rural women laborers told there was trend of unnecessary delay in wage payment.

The data displayed in the Table 9, shows that constraints faced by the rural women labour participant in scheme related to job card clearly underscore the facts that there were around 93.33 told that Elite group within workers capture most of job cards but in Karnataka 57.33 percent responded that Disparity in job card was observed in their villages.

The data provided in the Table 10, shows that constraints faced by the rural women labour participants in scheme related to facilities the facts that there was around cent percent told that there was no resting place but in Karnataka about 92.00 percent responded that some corrupt practices from the part of officers/ officials are present in their villages.

The results provided in the Table 11, shows that constraints faced by the rural women labour participants in scheme related to social norms of society and the facts that there was around 95.33 percent told that there was Social prohibition against women but in Karnataka about 46.00 percent responded that Family does not allow to work by their husbands which happens in their villages.

The perusal of Table 12 shows that suggestive measure given by the rural women labour participant in scheme with regard to smooth and effective functioning of scheme in rural areas of Punjab and Karnataka clearly underscore the facts that the respondents in the study area of Punjab shows that at about 95.33 percent of total respondents suggested that more agriculture-related activities should be provided for women's and 97.33 percent suggested more special provisions should be

Table 8. Constraints faced by the rural women labor participant in scheme related to wages

(Percent)

Problems	Punjab		Karnataka		Overall	
	Yes	No	Yes	No	Yes	No
Bank is far away from home	86.00	14.00	76.00	24.00	81.00	19.00
Unnecessary delay in wage payment	100.00	0.00	89.33	10.67	94.67	5.33
Complex procedure of receiving money from bank / post office	14.67	85.33	78.67	21.33	46.67	53.33
Payment is not delivered in villages	16.00	84.00	81.33	18.67	48.67	51.33
Very low wage rate	90.67	9.33	82.67	17.33	86.67	13.33
Any discrimination while receiving wage payment	0.00	100.00	44.67	55.33	22.33	77.67
Whether wage rates was the same for males and females	99.33	0.67	100.00	0.00	99.67	0.33

Source: Survey data, 2016-17.

Table 9. Constraints faced by the rural women labor participants in scheme related to job card

(Percent)

Problems	Punjab		Karnataka		Overall	
	Yes	No	Yes	No	Yes	No
Disparity in job card registration	67.33	32.67	57.33	42.67	62.33	37.67
More job card and less employment	98.00	2.00	41.33	58.67	69.67	30.33
Misuse of job card	7.33	92.67	39.33	60.67	23.33	76.67
Fake entries in job cards	7.33	92.67	40.00	60.00	23.67	76.33
Elite group within workers capture most of job card	93.33	6.67	40.00	60.00	66.67	33.33
Are you discriminated in allocation of work and distribution of job cards	8.67	91.33	45.33	54.67	27.00	73.00
More procedural difficulties in terms of money and time for registration	95.33	4.67	36.00	64.00	65.67	34.33

Source: Survey data, 2016-17.

provided for elderly women/widows in the Scheme and 98.00 percent of respondents told Social prohibition should be reduced. Scheme should be more refocused towards creating durable assets in agriculture was suggested by around 96.00 percent of respondents. In Karnataka the respondents in the study area suggested around 94.67 percent told that more training sessions may be organized to train the women workers, to generate more awareness about the scheme. At about 94.00 percent of respondents told that Payment procedure through bank or post office should make less hectic and around 94.00 percent told that regular work should be given to them. At about 90.67 percent of respondents shared that wages should be given on time and regular basis.

CONCLUSION AND POLICY IMPLICATIONS

Based on the results appeared from this comparative performance positive significances was yielded regarding the efficiency of the MGNREGS. Multistage random sampling was used in household-level data on two Indian states encompassing over 6 districts and 300 sampled rural women laborers during 2016-17. In both the states majority of assets created related to road development, land development and rural sanitation was undertaken. Due to lack of funds and insufficient balances in respective villages with their allotted funds some of the works was not completed and it was observed that a project approved by gram panchayat was ongoing works that will take time to complete was seen in Punjab and the major problems observed are due to illiteracy, feel difficulty in filling application form for further process, untimely measurement of work, lack of adequate work, irregularity in work, harassment during work, and in Karnataka the major problems are related to low technical unskilled work, no resting place, lack of child care facility at MGNREGS site and corruption practices from the part of officers/ officials was highly observed. Suggestions given by the majority of rural women labour participants in scheme in the context of further improvement of scheme are as follows regular work should be given, minimum 100 days employment should be given, wage rate should be increased, awareness among the rural women should be increased, skill work should be provided, procedure should be simplified, social prohibition should be reduced etc. these findings are therefore a pointer to the fact that a public work programme such as MGNREGS plays an important role in influencing women labourers and creating more awareness among women workers that make the scheme

Table 10. Constraints faced by the rural women labor participants in scheme related to facilities

(Percent)

Problems	Punjab		Karnataka		Overall	
	Yes	No	Yes	No	Yes	No
Transport facilities is not available	86.00	14.00	67.33	32.67	76.67	23.33
Non- availability of drinking water	9.33	90.67	53.33	46.67	31.33	68.67
Non- availability of medical aid at working site	95.33	4.67	68.00	32.00	81.67	18.33
No resting place	100.00	0.00	83.33	16.67	91.67	8.33
Lack of child care facility at MGNREGS site	98.67	1.33	88.67	11.33	93.67	6.33
Any corruption practices from the part of officers/ officials	50.67	49.33	92.00	8.00	71.33	28.67
Are you feeling that there is lack of coordination among women beneficiaries, local bodies and state level authority	92.67	7.33	76.67	23.33	84.67	15.33

Source: Survey data, 2016-17.

Table 11. Constraints faced by the rural women labor participant in scheme related to social norms of society

(Percent)

Problems	Punjab		Karnataka		Overall	
	Yes	No	Yes	No	Yes	No
Family does not allow to work	20.67	79.33	46.00	54.00	33.33	66.67
Lack of motivation by family members	54.00	46.00	38.00	62.00	46.00	54.00
Tenacious social norms for working outside home	8.67	91.33	33.33	66.67	21.00	79.00
Social prohibition	95.33	4.67	37.33	62.67	66.33	33.67
Women are not allowed to work for a long period	5.33	94.67	34.00	66.00	19.67	80.33

Source: Survey data, 2016-17.

Table 12. Distribution aspects according to the suggestions given by the rural women labor participants in the context of further improvement of scheme

(Percent)

Suggestions	Punjab		Karnataka		Overall	
	Yes	No	Yes	No	Yes	No
Regular work should be given	94.00	6.00	94.67	5.33	94.33	5.67
Minimum 100 days employment should be given	94.67	5.33	92.67	7.33	93.67	6.33
Wage rate should be increased	94.67	5.33	88.67	11.33	91.67	8.33
Awareness among the rural women should be increased	99.33	0.67	89.33	10.67	94.33	5.67
Skill work should be provided	99.33	0.67	74.67	25.33	87.00	13.00
Procedure should be simplified	98.67	1.33	77.33	22.67	88.00	12.00
Social prohibition should be reduced	98.00	2.00	77.33	22.67	87.67	12.33
Constraints should be quickly tackled through grievances redressal	4.00	96.00	76.00	24.00	40.00	60.00
Wages be given in cash form	4.00	96.00	32.00	68.00	18.00	82.00
Facilities like tea and food arrangements be given at work site	96.00	4.00	90.67	9.33	93.33	6.67
Muster rolls should be well scrutinized	94.67	5.33	88.67	11.33	91.67	8.33
Wages should be given on time and regular basis	96.00	4.00	90.67	9.33	93.33	6.67
Participation of women in planning, implementation, and social audits	96.00	4.00	86.67	13.33	91.33	8.67
Linking of MGNREGS with others schemes should be increased	10.67	89.33	80.67	19.33	45.67	54.33
Number of employment days must be increased in drought-affected areas	94.67	5.33	90.67	9.33	92.67	7.33
Allocation of funds in states/ districts should be increased	94.00	6.00	91.33	8.67	92.67	7.33
More agriculture-related activities should be provided for women's	95.33	4.67	91.33	8.67	93.33	6.67
Women in trained staff should be increased	96.67	3.33	92.00	8.00	94.33	5.67
Employment should be increased during agriculturally lean seasons.	94.67	5.33	86.00	14.00	90.33	9.67
Scheme should be more refocused towards creating durable assets in agriculture.	96.00	4.00	88.00	12.00	92.00	8.00
More Provision for the semi-skilled and skilled workers should be incorporated	94.67	5.33	90.00	10.00	92.33	7.67
More special provisions should be provided for elderly women/widows in the Scheme	97.33	2.67	91.33	8.67	94.33	5.67
Mechanism should be evolved to restrict political interference in the scheme	94.67	5.33	76.67	23.33	85.67	14.33
More training sessions may be organized to train the women workers, to generate awareness about the scheme	2.67	97.33	94.67	5.33	48.67	51.33
Payment procedure through bank or post office should make less hectic	2.00	98.00	94.00	6.00	48.00	52.00
More attention should laid on motivating factors to minimize the vulnerable and hindering factors	2.67	97.33	34.67	65.33	18.67	81.33
Women members of GP should also be involved, in large measure, in social mobilization and guidance to women workers	89.33	10.67	70.00	30.00	79.67	20.33
Drudgery need to be addressed by making available Gender-sensitive / women-friendly tools.	91.33	8.67	68.00	32.00	79.67	20.33

Source: Survey data, 2016-17.

REFERENCES

Ministry of Rural Development. (2011). *MGNREGS sameeksha report to the people.* Ministry of Rural Development, Government of India: (Pp. 15-36), New Delhi.

Ministry of Rural Development. (2014). *MGNREGS implementation report to the people*. Ministry of Rural Development, Government of India: (Pp. 23-47), New Delhi.

Ministry of Rural Development. (2015). *MGNREGS Sameeksha-II an anthropology of research studies.* Ministry of Rural Development, Government of India: (Pp. 84-98), New Delhi.

Ministry of Rural Development. (2017). Retrieved from www.nrega.nic.in/.

Singh, G., Singh, B., & Singh, S. (2016). MGNREGS and weaker sections in Punjab: Performance, problems and possible solutions. *Indian Journal of Economics and Development, 12*(3), 503-514.

Vanitha, S.M. (2010). *An economic analysis of MGNREG programme in Mysore district of Karnataka* (Master's Thesis). University of Agricultural Sciences, Bangalore.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 535-540
DOI: 10.5958/2322-0430.2018.00108.7

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Perceptions of Rural Women about Degradation of Renewable Natural Resources in *Kandi* Area of Punjab

Jaspreet Kaur, Varinder Randhawa and Ritu Mittal*

Department of Home Science Extension and Communication Management
Punjab Agricultural University, Ludhiana-141004 (India)

Corresponding author's email: jasdkaur@yahoo.com

Received: January 15, 2018 *Manuscript Number: NS-18-114* *Revision Accepted: March 10, 2018*

ABSTRACT
A large majority of respondents reported that natural resource degradation affects their ecological environment, as availability through other sources of potable water was not adequate, women depended largely on tap water. Majority of the respondents used wood followed by LPG during summer, winter & rainy season and they realized that wood availability reduced during the rainy season. Overall huge majority reported the high level of degradation of natural resources. The respondents opined that depletion of fuel, fodder & water has impacted their lives to a large extent.

Keywords
Degradation, *Kandi* area of Punjab, renewable natural resources, rural women.

JEL Codes
Q20, Q23,Q25, Q51, Q54.

INTRODUCTION

Increasing demand for Natural Resources (NRs) has to lead to resources degradation and exploitation. With each millennium, new advances in the sophistication of use and accumulation of material resources due to the ever-increasing population and development are resulting in the destruction of the ecosystem and natural habitat, and the intensification (growth) of agriculture for demand-driven commodity production. All these have led to degraded landscapes, resources and loss of potentially renewable resource to the great detriment (loss) of the wildlife and rural communities (Vijaya, & Ranko-Goic, 2012). Thus, sustainable practices for management of NRs to meet the need of survival for both the present and future generations are of crucial concern to all societies. The consequence of degradation of the resources is no longer localized as it affects everyone. For example, the ever-increasing population needs more resources. Similarly, development resulting in the destruction of NRs and ecosystem, and intensification of agriculture for increasing production to meet market demand; all contribute to today's fast depletion of NRs. In addition, clearing of forests for firewood, for new farmlands or to realize expensive furniture lead to degraded landscapes and loss of potential renewable resources. The overall impact and contribution of this degradation to global warming are, however, far wider with greater ramifications. The global consciousness on the degradation of NRs resulting in gradual depletion of ecological services and life support systems is growing. We need to turn to better management practices to moderate the impact and renew these resources for future use (Karshener, 1992).

The close association between women and NRs especially rural women is an acknowledged fact(Carolyn, 1996; Upadhyay, 2005). The association exists because of their social and economic role which over generations has required them to fetch the family food, water, fuel, fodder, and income from surroundings resource base (Saxena, 1991). Traditional practices and bureaucratic factors often prevent their access to NR development and management (Kelkar, 1992). It is direct consequence is the dilemma we are facing of involving women in managing the wealth of natural resource in a better and

effective manner. There is need therefore to study management of renewable natural resources (RNR) from the perspective of women and their microenvironment and generate data on their perceptions about the degradation of renewable natural resources.

MATERIAL AND METHODS

Locale of the Study

The study was conducted in *Kandi* area of Punjab. *Kandi* area falls in the sub-mountainous undulating zone which stands along the eastern border and lies between Chandigarh, Hoshiarpur, Dasuya, Mukerian road and the Shivalik foothills of Punjab. The area has been selected because of itsrich biodiversity, rainwater resource, suitability for forestry etc. Besides, women in this area enjoy an intimate relationship with agriculture and animal husbandry operations and participate in a huge way in these operations. From this area, Nawanshahr (Shaheed Bhagat Singh Nagar) district was selected by application of simple random sampling technique. Out of total five blocks in this district namely Aur, Nawanshahr, Balachaur, Saroya and Banga, one block i.e. Balachaur was selected randomly. From the selected block, *Takarla* village was purposively selected due to its large size, easy access to socio-economic and ecological conditions and availability of natural resources to rural women.

Selection of Respondents

From the selected village, a sample of 100 women who were actively engaged in managing and utilizing the natural resources at household level was drawn through simple random sampling technique.

Data Collection

Data were collected from primary and secondary sources of information. Primary source included information collected through interview schedules as well as PRA techniques. The secondary sources used were literature, scientific information as well as revenue records of the village.

Data Analysis

All filled up interview schedules were transferred to master tables, tally sheets, and frequency tables and then analysis was carried out using frequencies, percentages, range and cumulative cube root methods.

RESULTS

Respondent's Perception of Degradation of Natural Resources

The respondent's perceptions regarding the effect of natural resource degradation were captured in term of their social, cultural, political, economic and ecological environment. The results revealed in the environment has captured the effect of natural resources on life pattern, place of procurement and status of natural resources (Table 1). It that a huge majority (85 percent) perceived degradation in their natural environment (ecology) followed by those who reported degradation in the social environment (80 percent). The degraded cultural environment was reported by 75 percent of the respondents while 70 percent of the respondents reported degradation in the economic environment. It can be inferred that majority rated most degradation/depletion having occurred in the soil, water, air, fuel, fodder and forest resources impacting overall ecology. This was followed by the perceived change in living style, dietary habits, family structure, dressing pattern and health-related disorders. The χ^2 (47.11) indicated that the perception of the sampled respondents with respect to the effect of degradation on different types of environment varied significantly. Also, a sizable percentage of the respondents (45 percent) reported political degradation in the environment.

Table 1. Perceived effect of natural resource degradation on different types of environment

Type of environment	Yes	
	No.	Percent
Social	80	80.00
Cultural	75	75.00
Political	45	45.00
Economical	70	70.00
Ecological	85	85.00

*χ^2: 47.11***

Adequacy of Water during Different Seasons

Perceptions of respondents regarding the adequacy of water during different seasons have been presented in Table 2. Multiple sources of water are used by respondents for different activities like bathing, washing, cleaning, animal care purpose etc. Cent-percent respondents used tap water for domestic chores and its availability was reported to be adequate by 98 percent of the respondents in winter and rainy season and by 95percent in summer. Availability of water from the well was found to be adequate by 83.33 percent of users in the rainy season and 75 percent in the summer season. Incidentally, only 12 respondents used the well water and 4 used pond for animal bathing purposes. Pond water availability was found to be adequate by 100 percent during winter and rainy seasons and 50percent respondents in summer. Only 4 respondents used the submersible pump and water availability through this source was 100 percent in all seasons. The overall majority of the respondents reported no scarcity of water during all seasons in this area. The values of χ^2 (50.77 and 31.22) indicated that perceived availability of water from different sources with respect to summer and winter seasons varied significantly due to infrequent and occasional use of some sources by the respondents. In the rainy season, the majority of the respondents reported adequate supply from all the sources of water. It reflects that with the continued degradation of natural resources. Rains may decrease people who feel adequate supply these days will face the other side of the coin.

Fuel Availability

Perception of the respondents regarding the

availability of fuel sources during different seasons has been presented in Table 3. Multiple sources of fuel were used by respondents mainly for cooking purposes. Ninety percent (90 percent) respondents used wood as the major source of fuel. Wood availability was found to be adequate by 91.11 percent of the respondents in summer and winter seasons and by 88.88 percent in the rainy season. LPG use was reported by 59 respondents out of 100 and its availability was reported to be adequate by 93.22 percent of the respondents in summer and 84.75 percent in winter and rainy seasons. Twenty-two respondents were using kerosene and its availability was found to be adequate by 81.81 percent in summer. However, 31.81 percent found kerosene availability to be inadequate during winter and rainy seasons. Thirteen respondents used traditional fuel that is, cow dung cakes. Availability of this resource was found to be adequate by all of them during all seasons. Agro-waste was used as fuel by 4 respondents and its availability was found adequate in all seasons. Three respondents used electronic gadgets like oven etc and all were satisfied with its availability. The values came out to be χ^2 4.81, 11.79 and 9.97 indicated that perceived availability of fuel sources with respect to summer, winter and rainy seasons did not vary significantly. So, availability and adequacy were found to be satisfactory in all seasons.

Fodder Availability

The perception of the respondents regarding the availability of fodder during different seasons is presented in Table 4. The variety of fodder used by the majority of respondents 95 included Barseem, jawar / bajra, oilseed cake and toori. Grass and loppings of trees and bushes were used by very few (6) respondents. Amongst Barseem users, Barseem availability was found

Table 2. Perceived availability of water in different seasons

Source of water		Summer		Winter		Rainy	
		Adequate	Not adequate	Adequate	Not adequate	Adequate	Not adequate
Well (n_1=12)	No.	3	9	7	5	10	2
	Percent	25.00	75.00	58.33	41.67	83.33	16.67
Pond (n_2=4)	No.	2	2	4	-	4	-
	Percent	50.00	50.00	100.00	-	100.00	-
Tap water (n_3=100)	No.	95	5	98	2	98	2
	Percent	95.00	5.00	98.00	2.00	98.00	2.00
Submersible pump (n=4)	No.	4	-	4	-	4	-
	Percent	100.00	-	100.00	-	100.00	-
χ^2		50.77**		31.22**		7.44	

Percent exceeds 100 due to multiple responses.
****Significant at 5 percent level.***

Table 3. Perceived availability of fuel in different seasons

Source of fuel		Summer		Winter		Rainy	
		Adequate	Not adequate	Adequate	Not adequate	Adequate	Not adequate
Wood (n_1=90)	No.	82	8	82	8	80	10
	Percent	91.11	8.88	91.11	8.88	88.88	11.11
Cow dung cakes (n_2=13)	No.	13	-	13	-	13	-
	Percent	100.00	-	100.00	-	100.00	-
Agro-waste (n_3=4)	No.	4	-	4	-	4	-
	Percent	100.00	-	100.00	-	100.00	-
LPG gas (n_4=59)	No.	55	4	50	9	50	9
	Percent	93.22	6.78	84.75	15.25	84.75	15.25
Kerosene (n_5=22)	No.	18	4	15	7	15	7
	Percent	81.81	18.18	68.18	31.81	68.18	31.81
Electronics (n_6=3)	No.	3	0	3	0	3	-
	Percent	100.00	0.00	100.00	0.00	100.00	-
χ^2		4.81		11.79		9.97	

Percent exceeds 100 due to multiple responses.
****Significant at 5 percent level.***

to be adequate by 87.37percent of the respondents in the winter season and Jawar/bajra availability was found to be adequate by the cent. Percent respondents in summer and 94.73 percent in the rainy season. Grass availability was found to be adequate by all of the respondents in the rainy season and sixty-six percent respondents feel that it is available in summer and winter season. Loppings of trees and bushes were found to be adequate by 100 percent of those using it 6 in the rainy season and 83.33 percent in winter and 50 percent in the summer season. Oilseed cake availability was found to be adequate by 97.89 percent of the respondents in winter season followed by 94.74 percent during summer and 91.58percent during the rainy season. Toori availability was found to be adequate by 95.79 percent of the respondents in winter season followed by 89.47 percent during the rainy season and 66.32 percent during the summer season. The values of χ^2 i.e. 59.87 and 16.36 respectively indicated that perceived availability of fodder sources with respect to summer and winter seasons varied significantly.

Perception about Degradation of NRs

The results presented in Table 5 revealed that huge majority of the respondents reported the high level of degradation of water (89 percent), land (78 percent), fuel (72 percent) air (70 percent) and fodder (69 percent). They also reported an alarming damage to wildlife because of environmental degradation so much so that barring negligible percentage of surviving animals like Neel gaiya, deer, and rabbits, others have become extinct. The values of χ^2 33.42 indicated that perception of respondents about the extent of degradation varied significantly. They believed that destruction is caused by increasing population, industrial development, technological interventions and other aspects of modernization. The χ^2 value 148.61 was significant which shows that reasons for degradation vary to a good extent.

Sources of Procurement of Water

The information in Table 6 reflects the frequency with respect to different sources of procurement of water. The data shows that 100 percent of the 12 respondents

Table 4. Perceived availability of fodder in different seasons

Fodder		Summer		Winter		Rainy	
		Adequate	Not adequate	Adequate	Not adequate	Adequate	Not adequate
Barseem (n_1=95)	No.	-	-	83	12	-	-
	Percen	-	-	87.37	12.63	-	-
Grass (n_2=6)	No.	4	2	4	2	6	-
	Percen	66.67	33.33	66.67	33.33	100.00	-
Jawar/ Bajra (n_3=95)	No.	95	0	-	-	90	5
	Percen	100.00	0.00	-	-	94.73	5.26
Lopping of trees and	No.	3	3	5	1	6	-
	Percen	50.00	50.00	83.33	16.67	100.00	-
Oilseed cake (n_4=95)	No.	90	5	93	2	87	8
	Percen	94.74	5.26	97.89	2.11	91.58	8.42
Toori (n_5=95)	No.	63	32	91	4	85	10
	Percen	66.32	33.68	95.79	4.21	89.47	10.53
χ^2		59.87*		16.36*		2.92	

Percent exceeds 100 due to multiple responses.
*****Significant at 5 percent level.***

Table 5. Perception of respondents about degradation of natural resources

(Percent)

Natural	Extent of degradation			Reasons for degradation			
	Low	Moderate	High	Development modernization	Technology intervention	Industrial	Increase in population
Water	6	5	89	80	60	30	50
Fuel	11	17	72	81	50	35	75
Fodder	8	23	69	85	60	10	70
Land	10	12	78	80	85	15	80
Air	10	20	70	90	80	80	50
Wild life	3	5	92	90	10	60	60
χ^2		33.42**			148.61**		

*****Significant at 5percent level.***

who used well water did not over source but used the community facility. Also, all the 4 respondents using pond water used it as a community facility while 94percent of the 100 respondents using tap water supply, had private connections and while 6percent used community taps all the 4 respondents who had the submersible pump, used it as a private facility for their own requirements. This information reveals that there is changing the trend in using alternative sources of water to meet domestic requirements. The reason could be attributed to low level of underground water due to which people are installing submersible pumps and resorting to tap the water supply. The value of χ^2 (120.29) indicated that the perception of the sampled respondents with respect to sources of procurement of water varied significantly.

Sources of Procurement of Fuel

The results presented in Table 7 showed that 50.0 percent of the 90 respondents used wood as fuel from their own sources, 41.10 percent from community sources and 8.9percent through purchase. Cent. percent of the 13 respondents using cow dung cake as fuel had their own sources. All the 4 respondents who used agro waste as fuel collected it from natural sources without paying for it. All the 59 respondents who reportedly used LPG as fuel purchased it. All the 22 respondents who used kerosene purchased it from the market. All the 3 respondents who used electronic gadgets like oven etc for cooking paid in the form of electricity bills. This information revealed that there is changing the trend in the procurement of fuel probably due to degradation of the natural environment and less availability of naturally growing fuel as well as lack of availability of time to invest in the collection of naturally growing fuel. The value of χ^2 (176.52) indicated that different sources of procurement of fuel varied significantly.

Sources of Procurement of Fodder

The results presented in Table 8 showed that 93.68 percent of the 95 respondents using barseem as fodder procured it from their own sources and 6.31percent through market purchase. Approximately 83.33percent of the 6 respondents who used grass as fodder procured it from community sources and 16.67percent from own sources. Around 93 percent of the 95 respondents who used jowar/bajra as fodder procured it from their own sources and 6.31percent through purchase. Loppings of trees and bushes used by 6 respondents were procured from community sources. Cent. percent of the 95 respondents who used oilseed cake purchased it from the market. Around 64 percent of the 95 respondents who reportedly used toori as fodder procured it from own sources and 35.79 percent through purchase. This information revealed that there is changing the trend in the procurement of fodder probably due to the destruction of naturally growing fodder and people relying more on fodder crops and market purchase. The value of χ^2 (287.52) indicated that the perception of the sampled respondents with respect to different procurement sources

Table 6. Sources of procurement of water by the respondents

Source of water		Own	Community	Purchase
Well (n_1=12)	No.	-	12	-
	Percent	-	100.00	-
Pond (n_2=4)	No.	-	4	-
	Percent	-	100.00	-
Tap water (n_3=100)	No.	94	-	6
	Percent	94.00	-	6.00
Submersible pump (n_4=4)	No.	4	-	-
	Percent	100.00	-	-

χ^2: 120.29.
Percent exceeds 100 due to multiple responses.
***Significant at 5 percent level.*

Table 7. Sources of procurement of fuel by the respondents

Source of fuel		Own	Community	Purchase
Wood (n_1=90)	No.	45	37	8
	Percent	50.00	41.10	8.90
Cow dung cakes	No.	13	-	-
	Percent	100.00	-	-
Agro-waste (n_2=4)	No.	4	-	-
	Percent	100.00	-	-
LPG gas (n_3=59)	No.	-	-	59
	Percent	-	-	100.00
Kerosene (n_4=22)	No.	-	-	22
	Percent	-	-	100.00
Electronics (n_5=3)	No.	-	-	3
	Percent	-	-	100.00

χ^2: 176.52.
Percent exceeds 100 due to multiple responses.
***Significant at 5 percent level.*

Table 8. Sources of procurement of fodder by the respondents

Fodder		Own	Community	Purchase
Berseem (n_1=95)	No.	89	-	6
	Percent	93.68	-	6.31
Grass (n_2=6)	No.	1	5	-
	Percent	16.67	83.33	-
Jowar/Bajra (n_3=95)	No.	89	-	6
	Percent	93.68	-	6.31
Lopping of trees and bushes (n_4=6)	No.	-	6	-
	Percent	-	100.00	-
Oilseed cake (n=95)	No.	-	-	95
	Percent	-	-	100.00
Toori (n_5=95)	No.	61	-	34
	Percent	64.21	-	35.79

χ^2: 287.52.; Percent exceeds 100 due to multiple responses.
***Significant at 5 percent level.*

for fodder varied significantly.

DISCUSSION

To summarize the information contained in Tables 1 to 8, it can be inferred that majority were aware of the environmental degradation problems occurring as a consequence of aberration in the natural environment. They confessed to the scarcity of underground water, fuel and fodder, air and water pollution and denuding of forests. Land degradation occurred to an extent that women faced problems for open defecation old practice during the day. The social and political aspects have influenced changes in family interaction patterns. Alongside have come some other unanticipated changes like change in family type, decision-making pattern, social gatherings, and change in dietary pattern and living styles of the families.

Many of the users reported that earlier they had to walk long distances for procurement of water but now drinking water is easily available at their doorsteps owing to supply of tap water. Similarly, easy availability of LPG especially for medium and high socioeconomic status families has reduced the necessity of walking long distances for fetching fuel. Social milieu and harmony have got adversely affected due to competitive and commercial tendencies of people to procure and use these NRs.

CONCLUSIONS

The results of the study show that majority of the respondents reported the high level of degradation of natural resources. They believe the cause of this degradation to be increasing population, industrial development, technological interventions & others aspects of modernization.

Women further shared that they switched on to tap water from submersible pumps as water labels are depleting. Although medium and high socio-economic status people have started using modern means of fuel like LPG etc., but low economic status people were facing difficulty in collection of fodder & fuel due to natural resource degradation.

DECLARATION

The authors declare that they do not have any conflict of interest and all authors have equal contribution in this work.

REFERENCES

Carolyn, E. (1996). *Gendered fields: Rural women, agriculture, and environment.* Boulder. USA: Westview Press.

Karshener, M. (1992). *Environment, employment, and sustainable development.* Working paper. World employment Program. ILO, Geneva.

Kelkar, G. (1992). *Women, peasant organisations and landrights: A study from Bihar, India*. Bangkok: AIT

Saxena, N.C. (1991). *Women and wasteland development-Policy issues.* New Delhi: International Labour Office.

Upadhyay, B. (2005). Women and natural resource management: Illustrations from India and Nepal. *Natural Resources Forum, 29*, 224-232.

Vijaya, V.R., & Ranko-Goic, R. (2012). A review of climate change, mitigation, and adaptation. *Renewable and Sustainable Energy Reviews*, *16*(1), 878-897.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 541-548
DOI: 10.5958/2322-0430.2018.00109.9

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Extent, Magnitude and Causes of Tenancy in Central Zone of Punjab

Jagjeet Singh and M.K. Sekhon*

Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141004

**Corresponding author's email: bittusandhu46@gmail.com*

Received: January 15, 2018 *Manuscript Number: NS-18-129* *Revision Accepted: March 07, 2018*

ABSTRACT

The study has been carried out with the objectives to work out the extent, magnitude,and cause of tenancy in central zone of Punjab. Primary data were collected during the year 2015-16. A total number of 120 farmers were purposely selected, out of which 62 (51.66 percent) farmers were involved in lease-in land and 58 (48.33 percent) were involved in lease-out land transactions. There were four pure tenant farmers (3.33 percent) in the sample. The number of farmers who lease-in land was the highest among semi-medium (25.80 percent) and medium farmers. The number of farmers who lease-out land was the highest among small, marginal and semi-medium (25.86 percent) farmers and lowest among large farmers (12.06 percent). The average land rent per acre was ₹47466 and 41091 of Moga and Amritsar districts respectively with the range of ₹37000 to ₹50000. Lack of non-farming employment opportunities was emerges as the major reasons for acquiring leased-in land and lack of resources has emerged as the major reasons for lease-out land. The surplus resources available on the farm, non-viability of small farm, lack of opportunity than agriculture had positively and significantly influenced agricultural lease-in market. However, in lease-out land market high land rent, regular service, residing abroad contributed positively and significantly. Government must in explore the possibilities to generate non-farm employment, fixation of fair land rent, limits on land area to be leased-in to improve the land lease market in Punjab.

Keywords
Employment, land rent, tenancy, transactions.

JEL Codes
G12, L85, Y40.

INTRODUCTION

With the rapid increase in population and development in the absence of employment opportunities other than agriculture sector the demand for resources, especially cultivated land increased. In India, the pressure exerted by growing economy on land and other natural resources have signified in post-liberalization period the demand for the conversion of the fair land for non-agriculture uses increases (Bardhan & Tewari, 2010; Jiang *et al*., 2011). On supply side, the most important reason for sale/lease out land is the low income from agriculture. As such, every year a large number of farmlands are being shifted to non-agriculture uses in all countries (Prasad & Manikandan, 2016). These are research studies in India. However, the state agriculture is at this time facing many difficulties which are hampering its potential for realizing higher growth in future.

Punjab experienced very rapid transformation in its agriculture economy. Since 1965-66 till 1982-83, fertilizer consumption increased almost fifteen times, consumption of electricity in agriculture more than six times, and area irrigated by wells and tube wells more than doubled. By 1982-83, area irrigated by all source was 84 percent of the net sown area. A technological transformation with this magnitude is bound to have a profound impact on tenancy structure of the state (Singh, 1989). The new farm technology has many implications for productivity, resources use pattern and labour, as the fact that landlessness and inequality in land ownership not changed much and incidence of tenancy has declined (Vaidyanathan, 1994). At the time of partition of the country, the major part of land was under-tenant cultivation. Land revenue records of Punjab indicated that land under tenant cultivation was 48.6 percent during 1947. During 1953-54 the leased out and leased in area was 38.10 percent and 23.07 percent respectively. While

the decade of 1970 brought remarkable changes in land relation in Punjab. Pure tenants was almost eliminated as it was 13.01 percent in 1970-71 and remained only 1.56 percent in 1980-81 (Gill, 1989). In 1991 number of small and marginal operational holding in Punjab was five lakh and it declined to three lakh during 2005. It means two lakh marginal and small farmers have left farming, in which 36 percent sold of their total land, 11.4 percent sold partial land and about 52.5 percent have leased out their land (Singh *et al*., 2007). The phenomenon of reverse tenancy occurs under which the small and marginal framers started leasing out land to medium and large farmers. The proportion of owner farms increased from 55 percent during 1980 to 80.18 percent during 2010-11, therefore, the percentage of tenant farms decreased from 1.5 percent during 1980 to 0.49 percent during 1990 and become zero in later period (Sharma *et al.*, 2014). With this backdrop, the present study was undertaken to examine the various aspect of tenancy relations like magnitude, extent and factor responsible and so on.

METHODOLOGY

The paper is based on primary data collected from central zone of Punjab. Multistage stratified random sampling technique was used. District and Block as first stage sampling unit, village as second stage sampling unit and respondent farm household was taken as the ultimate sampling unit has been adopted in order to select a representative sample. The districts Moga and Amritsar were selected to represent the high and low value productivity of crops in the state. The value of crop out was comparatively high in Moga district and low in Amritsar district during 2012 (Sekhon & Kaur, 2016). Further, there are 5 blocks in Moga district and 9 blocks in Amritsar district, two blocks from each district namely block Dharamkot and Moga-2 from Moga district and Block Tarsikka and Jandiala guru from Amritsar district were selected randomly. Three villages from each selected block were chosen to give the fair representation to the districts. Thus total of 120 farmers were selected and categorized on the basis of owned land into different categories, that is, marginal, small, semi-medium, medium and large farmers.

Detailed information from the lessees and lessors were collected through structured schedule. The field visit was undertaken during November 2016. Simple statistical techniques like averages, frequencies, percentages etc. were used to work out extent and magnitude of tenancy and linear regression model was used to study the factors affecting land market. The following model was used to analyse the data

$$Y_i=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+.....+\beta_8X_8+u$$

For the lease-in land market

Y= Lease-in land (acre) β_0 = Constant Term

$\beta_1.....\beta_n$ = Regression Estimates

X_1 = Age (years), X_2 = Owned land (acre), X_3= Education (Years of schooling), X_4 = Land rent (₹), X_5 = Surplus resources available on the farm (Yes = 1, No = 0), X_6 = Surplus family labour (Yes = 1, No = 0), X_7 = Less net return from small farms (Yes = 1, No = 0), X_8 = Lack of opportunities other than agriculture (Yes = 1, No = 0), and u = Random error term

For the leased-out land market

Y = Lease-out land (acre)β_1 = Constant Term

$\beta_2.....\beta_n$ = Regression Estimates

X_1= Education (Years of schooling), X_2 = Family members (Numbers), X_3= High rent (Yes = 1, No = 0), X_4 = Service (Yes = 1, No = 0), X_5 = Abroad (Yes = 1, No = 0), X_6 = Moved out in other business (Yes = 1, No = 0), and u= Random Error Term

RESULTS AND DISCUSSION

Socio-Economic Profile of the Respondents

Socio-economic profile represented the social status of sampled respondents includes age, education, family size, farm size etc. of respondent farmers. In fact, there are strong socio-economic seems to adversely for farmers having greater access to lease in and leased out land. The literacy status influences the tenancy status, that is, land leased in was lesson in the case of literate farmers. Among different farm size categories, it has found that 15.38 percent small farmers were illiterate. Large portion of household's heads was observed in the category of adult (36-50 years) in the study area. On an overall basis, an average age of the head of the family estimated to be 42.37 years.

It was observed that family size in terms of number of workers available on farm have positively influenced the leasing in land. The size of the family also acquires important bearing on the tenancy pattern of the farmer. It appears that with the human resources available wider the households continue to lease in land and it is equally plausible that as the household endowed with less human resources wish to hold limited size of operational holding. It also measures the strength of the family in terms of

Districts	**Moga**		**Amritsar**	
Blocks	**Moga-2**	**Dharmkot**	**Jandiala Guru**	**Tarsikka**
Villages	Talwandibhangeria, Rauli, Lande k	Kaila, Moujgarh, Dharmkot	Nawankot, Devidaspura, Ranakalan	Niberwind, Sadhpur, Mattewal
Lessees	14	18	16	14
Lessors	16	12	14	16
Total	30	30	30	30

number of earners and dependents. As showed in Table 1, the average family size of medium farmers came out to be highest, the average family size of whole sample was 4.73 members. The average owned land of total respondents was 10.57 while operational land was 16.38 acre. Ownership of means of cultivation i.e. tractors, there was 78.57 percent large farmers had their owned tractors while for overall sample the proportion was 62.50 percent. It needs to mention here that the numbers of tractors has increased from 1.8 lakh to 4.88 lakh from 1980-81 to 2014-15 in Punjab. The data provided in table shows that in lease-in land activity small, marginal and semi-medium farmers' plays major role. The available literature on tenancy pattern showed that during late nineties marginal, small and landless farmers mostly adopted leasing-in practice whereas large farmers leased-out their land in Haryana (Pandey *et al.,*2000).While in Odisha the incidence of tenancy was relatively higher in the marginal and small size farmers than in large farmers (Mohapatra, 1994). Another study of Rajasthan stated that two-thirds of the total respondents participate who leased-in land were landless, Marginal and small farmers and about two-thirds medium and large participated in leased-out land (Pant *et al.,* 2000)

Extent and Magnitude of Land Lease Market

With the introduction of high yielding varieties in the late 1960s and large-scale mechanize of farm operations, Punjab agriculture had been totally transformed. A technical transformation of this magnitude was bound to have a profound impact on agrarian relations.

Compositions of tenants have also undergone a sea change from landless poor farmers to large farmers, because of utilization of capital assets. This phenomenon incurred the land rent in the state over time. During, 2010-11 the average land rent of Gurdaspur district was ₹17000 per acre (Kaur & Singh, 2011), Sub-mountain zone and South-western zone was ₹26254 and ₹30900 per acre respectively (Singh, 2017). Land rent as a major part of fixed cost in Punjab agriculture tends to increase every year causes drastic increase in fixed cost, consequently lower the return from crops.

The study observed that the range of land rent lies between ₹37000 to ₹50000 per acre (Table 2). The average land rent for all the sampled villages was about ₹44137 per acre. The highest land rent (₹50000) was found in Dharmkot block and the lowest land rent (₹37000) was found in both blocks of Amritsar district.In Moga district which considered as a highly productivity district, the average land rent was more than other district. The study concluded that there was a direct relationship between level of productivity and land rent. The result revealed that the most farmers who take land on lease were semi-medium farmers (25.8 percent), followed by medium (20.96 percent) with average lease-in area 11.18 and, 12.0 acres respectively (Table 3). The factor revealed that extent of leased-in land was not directly proportional to the magnitude of sampled farms corresponding to different farm size categories. The level of agricultural development also influences the leased-in activity. In the case of leasing-in activity, it was found that semi medium and medium farmers were dominated.

It has been observed that marginal, small and semi-medium farmers mostly engaged in leased-in activity. This depends upon mainly the condition of the farmers and availability of human resources or mechanical power on the farm. The average leased-in land operated by sampled farmers was 11.24 acre which was higher than the average owned land (10.57 acre). Farm size category-wise the average leased-in land in case of semi-medium and medium was estimated to be 11.18 and 12.0 acres, respectively, while the land owned by these farms was 8.87 and 17.46 acre respectively. In percentage term,

Table 1. Socio-economic profile of selected respondents in central zone of Punjab

(Number of farmers)

Particulars	Farm size category						
	Pure tenants	Marginal	Small	Semi-medium	Medium	Large	Overall
Average numbers of years in school	10	8.18	7.84	7.58	8.60	8.35	8.11
Average age (years)	39.5	44.59	43.23	45.19	42.82	42.07	42.37
Average family size	4.00	4.04	4.76	4.48	5.47	5.35	4.73
Number of farmers who lease-in land	4 (6.45)	10 (16.12)	12 (19.35)	16 (25.80)	13 (20.96)	7 (11.29)	62 (100.0)
Numbers of farmers who lease-out land	0 (0.00)	12 (20.68)	14 (24.13)	15 (25.86)	10 (17.24)	7 (12.06)	58 (100.0)
Average owned land (acre)	0	1.93	4.17	9.00	16.91	32.14	10.57
Average operational land (acre)	9.00	6.34	10.13	14.77	23.69	37.42	16.38
Ownership of means of cultivation	2 (50.00)	10 (45.45)	11 (42.30)	23 (74.19)	18 (78.26)	11 (78.57)	75 (62.50)

Figures in the parentheses indicate the percent to total.

leased-in area in relation to owned land was 473.17 and 34.41 for marginal and large farmers respectively. For overall sample proportion of leased-in area to owned area was 106.33 percent.

The magnitude and extent of agricultural land leased-out is evaluated on the basis of number of farmers leasing-out land and the total area being leased-out by them (Table 4). Among different size category of farm, the extent of agricultural land lease out was higher in semi-medium farmers (15) followed by small (14), marginal (12), medium (10) and large farmers (7) respectively.

Whereas, total land leased-out was highest in the case of large farmers; it was 194 acre in absolute term which constituted about 36.16 percent of total leased-out. Average leased-out area varied between 1.75- 27.71 acre for all categories of farms in the study area. The average leased-out area was the highest among large farmers where they leased-out land with an average of 27.71 hectares. The leased-out area by marginal, small, semi-medium and medium farmers was 1.75, 3.96, 8.73, and 13.5 acres, respectively. The proportion of leased-out area to owned land was the highest among marginal, small and semi-medium farmers who leased-out about 96 percent of their owned land. Similarly, the proportion of leased-out area to owned land for medium and large farmers was 83.33 and 82.54 percent, respectively.

As far as the leasing-out activity is concerned there is not much difference among the different categories of the farmers, though it is slightly higher in the case of marginal, small and semi-medium farmers. In the earlier period of transformation, large and medium categories of farmers leased out their land to small and marginal farmers due to labour availability. With mechanization of farms, the trend was observed to reverse as small and marginal farms leased out land due to non-availability of mechanical power, whereas large and medium farmers leased out with the adoption of the other occupation.

It shows as the farm size increases, the proportion of leased-out area to owned land decreases. The number of lessee was 62 and numbers of lessors were 58. The average owned land of lessees was 10.6 acre and the total leased in land was 12.36 acre in the sample blocks (Table 5). The proportion of leased-in land was 11.24 acre in the sample blocks. The average owned land of lessors was 10.57 acre and the average leased-out was 9.22 acre of sample farmers. The proportion of leased-out area to owned area was 87.39 percent. This table shows that the lessors were leasing out approximately 90 percent of their land. Leased-in area as percentage of owned land was highest for Dharmkot block (195.81 percent) and lowest in Tarsikka block (82.70 percent). The percentage of owned land was also highest in Dharmkot block (93.92 percent). On the whole, the farmers of all categories have engaged themselves in both leasing in and leasing out activities. The extent of these lease in activities depended upon land holding size, availability of machinery and equipments on farm, education level and other employment opportunities.

It has been observed during personal interaction of respondents that medium and large farmers having

Table 2. Range of land rent on sampled farms in central zone of Punjab, 2015-16

(₹per acre)

District	Blocks	Range of land rent	Average land rent	Average
Moga	Moga-2	43000-49000	47183.33	47466.66
	Dharmkot	44000-50000	47750.00	
Amritsar	JandialaGuru	37000-48000	41050.00	41091.66
	Tarsikka	37000-48000	41133.33	
Overall		37000-50000	44137.50	44137.50

Table 3. Farm size category-wise magnitude and extent of land lease-in among sampled farms

Farmer size categories	Number of farmers	Percentage	Average owned land (acre)	Total leased-in area (acre)	Average leased-in area (acre)	Average leased-in as a percentage of owned land
Pure tenant	4	6.45	0	36	9.0	-
Marginal	10	16.12	2.05	97	9.7	473.17
Small	12	19.35	4.25	155	12.91	303.76
Semi-medium	16	25.80	8.87	179	11.18	126.04
Medium	13	20.96	17.46	156	12	68.72
Large	7	11.29	30.71	74	10.57	34.41
Total	62	100.0	10.57	697	11.24	106.33

greater access to leased land because their desire and ability to maximize income through expansion of size of operational holding, especially when they lack the necessary skill, attitude, and opportunities for taking up non-farm activities. However, non-availability of capital input or credit with small and marginal farmers for investment in modern inputs and desire to maximize income through leasing-out land and wage earning by hiring out labour with in and out agriculture, if such of opportunity exist. But large-scale growth of reverse tenancy may alienate the marginal and small farmers from land with out giving then an alternative and addition source of income is dangerous for overall development

Reasons for Leased-in and Leased-out Agricultural Land

The structure of land lease market has been observed to be changed during the last few decades due to many reasons. It is important to know the reason for land leased in the rural economy.

Among the various reason stated lack of non-farming employment opportunities was emerges as the major reasons for acquiring leased-in land for cultivation (Table 6). This reason was reported by about 67.74 percent of total sampled farmers and all the pure tenant farmers. The other major reason of leased-in land was quoted by sample farmers as surplus of resources, that is, higher fixed investment in terms of machinery and agricultural equipments on farm (67.74 percent).

The degree of response with regard to this reason was highest in the case of medium (100 percent) followed by semi medium (93.75 percent). The same reason also quoted in that Haryana quantum of leased-in land by large farmers mainly due to their greater capacity to pay advance cash as rent of the land to the landowner. The availability of other farm resources was not a limiting factor most of the farmers of all size groups possessed tractors, tube wells and other farm implements (Tomar *et al.,* 2000).

Land lease market refers to land transactions between landowners and tenants in terms of land leased-in and land leased-out, respectively. A large numbers of factors were reported to affect the land lease market in the Punjab state. The coefficient of multiple determinations (R^2) of lease-in land market function was 0.80 indicating the explanatory power of the model. The variables like age, land rent, surplus resources on farm, surplus family labour, less net return from small farms was significant at 1, 10, 1, 10 and 5 percent and its value was -0.119, -0.0002, 2.46, 1.38 and 1.88 respectively (Table 7). The other dummy variable like owned land, education and

Table 4. Category-wise magnitude and extent of land lease-out among sampled farms

Farmer categories	Number	Percentage	Average owned land (Acre)	Total leased-out area (acre)	Average leased-out area (Acre)	Area leased-out as a percentage of owned land
Marginal	12	20.68	1.83	21	1.75	95.62
Small	14	24.13	4.1	55.5	3.96	96.58
Semi-Medium	15	25.86	9.13	131	8.73	95.61
Medium	10	17.24	16.2	135	13.5	83.33
Large	7	12.06	33.57	194	27.71	82.54
Total	58	100.0	10.57	536.5	9.25	87.51

Table 5. Block-wise extent of tenancy in central zone of Punjab

(Acres)

Parameters	Blocks				
	Moga 2	Dharmkot	Jandiala Guru	Tarsikka	Total
Numbers of farmers	30	30	30	30	120
Total owned land of sampled farmers	306	323.5	295.5	344	1269
Numbers of lessees	15	17	16	14	62
Average owned land of lessees	9.53	10.41	10.31	12.17	10.6
Average lease-in land	17.53	7.23	10.62	10.07	11.24
Leased-in area as a percentage of owned land	183.88	69.42	103.00	82.74	106.03
Number of lessors	15	13	14	16	58
Average owned land of lessors	10.86	11.26	9.32	10.84	10.57
Average leased-out land	10.2	9.19	8.21	9.31	9.22
Leased-out area as a percentage of owned land	93.92	81.61	88.13	85.9	87.39

lack of opportunities other than agriculture were non-significant with value of 0.029,-0.068 and 1.55 respectively.

Age has negative value indicated that aged farmers were not interested in lease-in land and with increase in age the leased-in activities decreased because farmers at old age unable to do work. A overall study of Punjab state illustrates that the factors namely excessive resource, adjoining or near to owned land, large family size and low returns from small farms were found to be significant for leased-in land market while factors like lack of resources, old age, migrated abroad, less profit in agriculture and shortage of time were found to be significant of leased-out land market (Singh, 2017).

Table 6. Farm size category-wise reasons for leasing-in land by the sampled farmers

Reason for leasing-in land	Categories of farmers						Overall
	Pure tenant	Marginal	Small	Semi-medium	Medium	Large	
Surplus farm assets	0 (0.00)	1 (10.0)	7 (58.33)	15 (93.75)	13 (100.0)	6 (85.71)	42 (67.74)
Adjoining or near to owned land	0 (0.00)	8 (80.0)	4 (33.33)	6 (37.50)	3 (23.07)	6 (85.71)	27 (43.54)
Land of relative/friends who left farming	0 (0.00)	2 (20.0)	4 (33.33)	5 (31.25)	4 (30.76)	4 (57.14)	19 (30.64)
Working member on farm	0 (0.00)	5 (50.0)	5 (41.66)	4 (25.0)	3 (23.07)	1 (14.28)	18 (29.03)
Low income from small farms	0 (0.00)	7 (70.0)	7 (58.33)	12 (75.0)	3 (23.07)	0 (0.00)	29 (46.77)
Lack of opportunities other than agriculture	4 (100.0)	9 (90.0)	6 (50.0)	9 (56.25)	10 (76.92)	4 (57.14)	42 (67.74)
Fodder purposes	1 (25.0)	4 (40.0)	1 (8.33)	0 (0.00)	0 (0.00)	0 (0.00)	6 (9.67)

Figures in the parentheses indicate the percent to total.
Percent exceeds 100 due to multiple responses.

Table 7. Farm size category-wise reasons for leasing-out land by the sampled farmers

Reason for leasing out land	Marginal	Small	Semi-medium	Medium	Large	Overall
High land rent	7 (58.33)	7 (50.0)	5 (33.33)	2 (20.0)	0 (0.00)	21 (36.20)
Lack of resources	8 (66.66)	9 (64.28)	7 (46.66)	1 (10.0)	0 (0.00)	26 (44.82)
Away from home	3 (25.0)	3 (21.42)	3 (20.0)	2 (20.0)	1 (14.28)	12 (20.68)
Service	0 (0.00)	3 (21.42)	3 (20.0)	4 (40.0)	1 (14.28)	10 (17.24)
Abroad	0 (0.00)	0 (0.00)	0 (0.00)	3 (30.0)	4 (57.14)	7 (12.06)
Low income from agriculture	2 (16.66)	5 (35.71)	10 (66.66)	2 (20.0)	0 (0.00)	19 (32.75)
No earner in the family	0 (0.00)	1 (7.14)	2 (13.33)	2 (20.0)	1 (14.28)	6 (10.34)
Holdings in fragments	0 (0.00)	0 (0.00)	2 (13.33)	2 (20.0)	1 (14.28)	5 (8.62)
Moved out in other business	0 (0.00)	0 (0.00)	1 (6.66)	2 (20.0)	3 (42.85)	6 (10.34)
Location of field uneconomical for self-cultivation	4 (33.33)	2 (14.28)	1 (6.66)	2 (20.0)	0 (0.00)	9 (15.51)

Figures in the parentheses indicate the percent to total.
Percent exceeds 10 due to multiple responses.

Table 8. Regression analysis of factors affecting land lease-in market in central zone of Punjab, 2015-16

Variables	Lease-in		Lease-out	
	Coefficients	p-value	Coefficients	p-value
Intercept	-4.06	0.530	5.025	0.520
Age of family head	-0.199***	0.0031	-	-
Owned land	0.029	0.540	-	-
Education	-0.068	0.512	-0.112	0.604
Land rent	-0.0002*	0.081	4.14*	0.051
Surplus resources available on the farm	2.46***	0.0103	-	-
Surplus family labour	1.88*	0.0621	-0.149	0.804
Less return from small farms	1.38**	0.0145	-	-
Lack of opportunities other than agriculture	1.55	0.114	-	-
Service	-	-	7.69***	0.0002
Abroad	-	-	22.73***	0.000012
Moved out in other business	-	-	9.51***	0.00002
R^2	0.80		0.74	

, ** and *** Significant at 10, 5 and 1 percent level.

The coefficient of multiple determinations (R^2) of lease-out land market function was 0.74 which indicating the explanatory power of the model. The variables i.e. high rent, service, abroad and moved out in other business was significant statistically. The other variables i.e. education and family members were non-significant with value of -0.112 and -0.149 respectively. A study of Gujarat state (Shiyani & Vekariya, 2000) revealed that total owned land and the rate of lease had positive and significant influence on the area leased-out, whereas the family size influenced negatively.

CONCLUSIONS

The study concluded that the semi-medium and medium farmers were the major players of leased-in activity whereas small and marginal farms leased-out land activities in the study area. Average land rent in the study area was too high i.e. Rs 44137. The study also concluded that extent of leased-in land was inversely proportional to the magnitude of sampled farms corresponding to different farm size categories. The proportion of leased-in and leased-out area was highest among marginal, small and semi-medium farmers. Lack of non-farming employment opportunities was emerges as major reason for leased-in land while lack of resources was the major reason for leased-out land. Age, surplus family labour, surplus resources was significant factor for leased-in land while regular services, residing abroad and other business was significantly affect leased-out land. So, it is suggested that to enhance non-farming employment opportunities, fixation of fair lease rent, and limits on land area to leased-in may help in making the farming viable especially for the marginal and small farmers.

SUGGESTIONS

India is an agriculturist's land and near about 54 percent population depends on agriculture as a primary source of income. Similarly in Punjab state, there are less industrialisation than agriculture and lack of non-farming employment opportunities emerged as the most important reason for acquiring leased-in land for cultivation. This reason was reported by about 68 percent of the sampled farmers in the study area. They reported that they were forced to adopt agricultural occupation due to lack of non-farming employment opportunities. Thus policy planners may explore the possibilities to generate non-farm employment to sustain the livelihood of Punjab peasantry especially the landless farmers in the Punjab state. The study brought out that an average rental value of leased-in land prevailed in the sampled villages was to the tune of 44137 per acre, which is exceptionally high. Taking into account the existing rate of rental value, the landless, marginal and small farmers are not economically viable in the Punjab state. Therefore, the state government may regulate land lease market and ensure all land transactions under their control. Legal restrictions like fixation of fair land rent, limits on land area to be leased-in etc. may help in providing security to the tenants and landowner as well. The results indicated that medium and large farmers possessed relatively more farm resources and were capable of acquiring more area under cultivation. For utilization of excessive farm resources available with large farmers, they leased-in land at higher rent. This practice has led to unfair rise in land rent and uneven distribution of land in the Punjab state. In the interest of the farming community, the government may intervene to safeguard the interest of small farm category.

REFERENCES

Bardhan, D., & Tewari, S.K. (2010). An investigation into land use dynamics in India and land under-utilization. *Indian Journal of Agricultural Economics, 65*, 658-676.

Gill, S.S. (1989). Changing land relations in Punjab and implications for land reforms. *Economic and Political Weekly, 24,*A79-A85

Jiang, Q., Xiangzheng, D., Jinyan, Z., & Shujin, H. (2011). *Estimation of land production and its response to cultivated land conservation in North China plain*. Retrieved from http://egeoscien.neigae.ac.cn/EN/abs/ract/abstract8561.shtml.

Kaur, M., & Singh, S. (2011). Agricultural land lease market in Gurdaspur district of Punjab. *Journal of Agricultural Development and Policy, 21,* 51-60.

Mohapatra, K. (1994). Land, labour and credit market interlocking: A study of Orissa agriculture. *Indian Journal of Agricultural Economics, 49,* 339-340.

Pandey, U.K. Singh, D. Suhag, K.S., & Kundu, K.K. (2000). Contractual arrangement in land market under major production systems in rural Haryana. *Indian Journal of Agricultural Economics, 55,* 340.

Pant, D.C., Burark, S.S., & Singh, C.P. (2000). Socio-economic facets of contractual land arrangements in Rajasthan-An inter-regional analysis. *Indian Journal of Agricultural Economics, 55,* 335-336.

Prasad, G.P.K., & Manikandan, K. (2016).Farmland conversion and food security: Empirical evidences fron three villages of Tamil Nadu. *Indian Journal of Agricultural Economics, 77,* 493-503.

Sekhon, M.K., & Kaur, A. (2016). *Rural roads, markets and agricultural growth in Punjab: A district-wise analysis.* Department of Economic and Sociology, PAU, Ludhiana, India.

Sharma, V.K. Singh, S., & Singh, V.P. (2014). Changing structure of agriculture in Punjab. *Journal of Agricultural Development and Policy, 24,* 20-28.

Shiyani, R.L., & Vekariya, S.B. (2000).Emerging trend of contractual arrangement in land and labour markets-A case study of Junagadh district Gujrat. *Indian Journal of Agricultural Economics, 55*, 336-337.

Singh, G. (2017). *Agricultural land lease market in Punjab* (Master's Thesis). Punjab Agricultural University, Ludhiana.

Singh, I. (1989). Reverse tenancy in Punjab agriculture: Impact of technological change. *Economic and Political Weekly, 24,* 12-13.

Singh, K., Singh, S., & Kingra, H.S. (2007). *Status of farmers who left farming in Punjab*. The Punjab State Farmers Commission, Mohali and Punjab Agricultural University, Ludhiana.

Tomar, B.S. Singh, V.K., & Khatkar, R.K. (2000). Pattern of land lease and labour use in Haryana agriculture. *Indian Journal of Agricultural Economics, 55,* 348-349.

Vaidyanathan, A. (1994). Agrarian relation in the context of new agricultural technology. *Indian Journal of Economics and Development, 49*, 317-329.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 549-554
DOI: 10.5958/2322-0430.2018.00110.5

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Child and Maternal Nutrition in the Granary of India: A Study on Vulnerable in Punjab

Shalini Sharma[1], Ranjeet Kaur[2] and Simran K. Sidhu[1]*

[1]Professors of Sociology and [2]Research Fellow, Department of Economics and Sociology
Punjab Agricultural University, Ludhiana-141004

[*]Corresponding author's email: shalinisharma@pau.edu

Received: November 11, 2017 *Manuscript Number: NS-18-83* *Revision Accepted: March 05, 2018*

ABSTRACT

Elimination of stunting was set as a goal to meet the challenge of 'Zero Hunger' by the UN Secretary General and an important goal for sustainable development. The group of eight (G8) industrialized nations have also considered that investment in nutrition is the most effective way to achieve the objective of global welfare. Though Punjab is considered as the Granary of India and has been most dynamic in making the nation a food self-sufficient one but ironically, the nutritional status of its own people especially the vulnerable is not satisfactory. Children and women are susceptible to malnutrition due to low dietary intakes, infectious diseases, lack of appropriate care, and inequitable distribution of food within the household. An attempt had been made to gauge the nutritional status of the underprivileged section in Punjab. The study relied upon the data given in various issues of National Family Health Survey (NFHS-1,2,3, and 4 rounds), Census data, District Level Household& Facility Survey (DLHS-1,2, 3, and 4) conducted by International Institute of Population Sciences (IIPS) and various state level reports. The study found that though there was decline in percentages of stunted and underweight children, but there was increase in percentage of those suffering from wasting during the reference period. The state fares badly as for intake of micronutrients was concerned which was lower than the Recommended Dietary Intake amongst children and women. More than 50 percent of its children and more than 80 percent of its women folk were anemic. In addition, there existed gender, regional and caste based gaps in the nutritional status, thwarting the very goal of sustainable development. The causes of persistent undernutrition were deep-rooted, related to discrimination, inequality.

Keywords
Anemia, malnutrition, nutritional status of women and children, poverty.

JEL Codes
I30, I13, I14, I15.

INTRODUCTION

Malnutrition is one of the most devastating problems worldwide and is inextricably linked with poverty. Eliminating hunger and malnutrition is one of the most fundamental challenges facing humanity (Lomborg, 2004; Bhargava, 2006; Dewan, 2008). In terms of population and economics, India is one of the fastest growing countries with population of 1.3 billion. About 21.9 percent people are still living below the National Poverty Line (The Planning Commission, 2013).The Global Hunger Index (GHI) 2010 ranked India at 67 out of 122 countries; whereas the '2012 Global Hunger Index' (IFPRI) ranked it at 65 among 79 countries. India stood 97th position in 2016 rankings but in 2017, Global Hunger ranked India 100 out of 119 countries and placing the country in serious category (The Hindustan Times, 2017).

Poverty is reported as a main cause of malnutrition in India. It leads to inadequate food intake and undernutrition, impaired functioning, low productivity again leading to poverty (Khalakdina, 1979). Economic inequality is another cause for malnutrition in India. Due to the low social status of some population groups, their diet often lacks in both quality and quantity. Women who suffer malnutrition are less likely to have healthy babies. More than one-half of the 9.7 million children deaths worldwide are linked to undernutrition. Lack of proper

care, poor health, illiteracy, and ignorance are also some reasons of malnutrition (Gupta and Rohde, 2004).

Malnutrition alone not only kills but also exacerbates the burden of infectious diseases (USAID 2009). It is broadly perceived as a major health problem in developing countries. Malnutrition in India, especially among children and women, is widespread, acute and even alarming. This is reflected by the fact that the prevalence of underweight children in India is among the highest in the world, and is nearly double thanthat of Sub-Saharan Africa (Gragnolati *et al.,* 2005).

Elimination of stunting (short height for age) was set as a goal to meet the challenge of 'Zero Hunger' by the UN Secretary General and an important goal for sustainable development. The group of eight (G8) industrialized nations have also considered that investment in nutrition is the most effective way to achieve the objective of global welfare. Punjab is considered as "Granary of India", "breadbasket of a nation" and "richest state". It has played pioneer role in making nation a food self-sufficient. State produced large quantity of food grains as well as contributed a higher share to the central pool. But now it is often termed as a "once rich", "agrarian state' due to its declining economy, agrarian crisis and ill health plaguing people of all ages (Kurian, 2017).Punjab's statistics on the health of women and children is not satisfactory. The present research paper endeavors to study the basic demographic indicators of health in Punjab and also analyze the nutritional status of children and women in the state of Punjab.

METHODOLOGY

The present study was based on the secondary data procured from different sources. National Family Health Surveys I, II, III, and IV which were conducted in the years 1992-93, 1998-99, 2005-06 & 2015-16 respectively, provided database for analyzing nutritional status among children and adults. The nutritional status of adults is given in terms of the Body Mass Index (BMI), which has been calculated basing upon the anthropometric measures of height and weight and this measure can be used to understand the prevalence of under and overweight population. Data on anemia among children, pregnant women, ever married women and men were also procured from all four NFHS surveys. Official estimates of poverty in India were obtained from various issues of Government of India (n.d.) and Government of Punjab (n.d.). International Food Policy Research Institution (IFPRI) publications provided database for hunger statistics. Study referred to DLHS IV data to record intake of micronutrients. The regional and gender gaps of nutritional status were worked out through percentage point's method.

RESULTS AND DISCUSSIONS

Poverty reflected in all aspects of life of the poor people. According to Nobel laureate Amartya Sen, poverty is basically failure of 'entitlement'. Karl Marx was probably the first scholar to take note and comment on poverty in India. He commented and analyzed the poverty of Indian society in Articles on India published in New York's Daily Tribune. The poverty of Indian society according to Marx has been due to destruction of the earlier framework of society by the British without any attempt to build a new one. All developments during British rule had been oriented towards facilitating the drain of resources of India, resulting in greater poverty among the Indian masses (Sharma, 2012). According to World Bank report 2010, 32.7 percent of total Indian people fall below the international poverty line of US $1.25 per day while 68.7 percent lives on less than US $2 per day.

Economic Survey of India and Economic Survey of Punjab provided the data on poverty at national and state level respectively. Data indicated that there was increase in the percentages of population living below poverty line in India from 26.1 percent in 1999-2000 to 37.2 percent in 2004-05in India. Official estimates recorded a continuous decline in poverty rate from 2009 to 2012 (Table 1).

Further, the table interprets the picture of poverty in Punjab from the year of 1999 to 2012. Official estimates of poverty recorded 6.16 percent population of Punjab lived below poverty line in 1999-2000. But thereafter in the ensuing decades, poverty rate increased to 8.4 percent in 2004-05 and further to 15.9 percent of the total population in 2009-10. The Government of Punjab somehow had succeed in decreasing the poverty rate in next two years to 8.26 percent in 2011-12.Thus more than one fourth of urban India and one fifth of rural India are below poverty line. Situation in Punjab though is somewhat better at 10 percent of rural and 8 percent of urban under poverty but has lost its glory achieved during green revolution period.

Status of Undernourished in India

According to the State of Food Insecurity in the

Table 1. Official estimates of proportion of population below poverty line

Particulars	India			Punjab		
	Rural	Urban	Total	Rural	Urban	Total
1999-2000	24.1	26.8	26.1	5.75	6.35	6.16
2004-2005	25.7	41.8	37.2	7.1	9.1	8.4
2009-2010	20.9	33.8	29.8	18.1	14.6	15.9
2011-2012	13.7	25.7	21.9	9.24	7.66	8.26

Source: Economic Survey of India and Economic Survey, Government of Punjab (various issues).

World 2012', India remains home to the 217 million undernourished people in the world (17.5 percent of its population) in year 2012. The Table 2 shows the declining trend in the proportion of undernourished people (as percent of total population). But when it is comes to ranking at international level, India projects a dismal status. Though improved marginally compared to year 2008 when India was referred 102nd among 118 countries which come down to 97thrank among 118 countries, still it is far behind achieving its Millennium Development Goal (MDG) of bringing down the proportion of undernourished to 12.5 percent of the total population.

Nutritional Status of Children in Punjab

Three indices of physical growth describes nutritional status of children, that is, Height-for-age (stunting), Weight-for-height (wasting) and Weight-for-age (underweight). The resulspresented in the Table 3 shows that prevalence of stunting and underweight among children had decrease from the last two decades but percentages of wasted had increased over the period of 1998-99 to 2015-16. The data of NFHS IV indicated that one fourth of children under the age of 5 years were stunted, wasting was found to be about 15.6 percent and one fifth of them were underweight. From IInd and IIIrd round of NFHS, it was observed that percentages of stunted children (under age of 3 years) were higher in rural areas of Punjab as compared to urban areas. Further, during IV round, stunting was found more in urban areas than in rural areas of Punjab.

The change in the trend was significantly due to increase in urbanization trends captured during 2011 census. Due to stretched boundaries of major cities and towns, slums and squatters mushroomed and border lined colonies in the city after city in the above said period, contributing to increase in enumerating malnutrition in urban areas. Hence regional gap which was -12.8 during 1998-99 decreased to -2.5 in 2005-06 and further showed a tilt towards urban with a gap of 3.1 percent point in 2015-16.

Wasting was a serious problem in Punjab. Whereas Punjab fared well as for stunting and underweight was recorded but performed dismally on account of wasting among children. Study recorded a continuous decrease in

Table 2. Status of undernourished in India

Indicators	1992	2000	2008	2016	2017
GHI Score	46.4	38.2	36	28.5	31.4
GHI Rank	76	83	102	97	100
Proportion of undernourished (As percent of total pop.)	25	21	19	15.2	14.5

Source: IFPRI, Various Issues.
Figures in parentheses indicate total number of countries.

Table 3. Nutritional status of children in Punjab from 1992-93 to 2015-16

Particulars	Rural	Urban	Total	Regional Gap*
Stunned				
NFHS-I (Under 3 Years)	NA	NA	40.0	-
NFHS-II (Under 3 Years)	42.2	29.4	39.2	-12.8
NFHS-III (Under 3 Years)	35.4	32.9	34.7	-2.5
NFHS-IV (Under 5 Years)	24.5	27.6	25.7	3.1
Wasted				
NFHS-I (Under 3 Years)	NA	NA	19.9	-
NFHS-II(Under 3 Years)	7.0	7.4	7.1	0.4
NFHS-III(Under 3 Years)	10.0	10.7	10.2	0.7
NFHS-IV(Under 5 Years)	16.1	15.0	15.6	-1.1
Under Weight				
NFHS-I (Under 3 Years)	NA	NA	45.9	-
NFHS-II (Under 3 Years)	31.8	18.6	28.7	-13.2
NFHS-III (Under 3 Years)	25.9	19.6	23.6	-6.3
NFHS-IV(Under 5 Years)	21.1	22.4	21.6	1.3

National Family and Health Survey (NFHS-1 (1992-93), II- (1998-99), III- (2005-06) and IV- (2015-16).
****Gaps were worked out on Percentage Points Method.***

the percentages of children with stunting and underweight during the reference period whereas there was increase in the percentages of children who were underweight for their height. The proportion of underweight among children with age of 3 and 5 years had decreased in all four rounds of NFHS. It decreased from 45.9 percent in 1992-93 to 21.6 percent in 2015-16. Regional gap of -13.2,-6.3 and 1.3 percentages point pertaining to underweight during IInd, IIIrd and IVth NFHS rounds respectively recorded a continuous decline. Thus the study showed that Punjab had succeeded in bringing down the proportion of stunted and underweight. Ruralities were marginalized compared to their urban counterparts.

Nutritional Status among Adults

Body mass index (BMI) is calculated from a person's weight and height and is obtained as the individual's body weight (in Kgs) divided by the square of his or her height (in meters). It is the only indicator that includes all the three measurements of weight, height, and age. In recent years, it has become the most widely used diagnostic tool for screening and identifying underweight, overweight and obesity in population for both adults and children. Chronic energy deficiency is indicated by a BMI of less than 18.5 kg/m^2 while an individual with BMI of more than 25 kg/m^2 is considered overweight.

Obesity causes several non-communicable diseases such as cardiovascular diseases, diabetes, cancers and chronic respiratory diseases (WHO, 2012). Data in Table 4 present region wise overview on nutritional status of adults in terms of underweight and overweight or obesity. In Punjab 13.5 percent of the women and 12 percent, men were thin, that is, they had BMI below normal during 2005-06. The incidence of thinness was higher among women in rural areas than their counterpart while in case of men it was slightly higher among urban men compared to their counterparts in rural areas. NFHS IV round recorded decrease in percentages of population having the BMI below normal. It was 11.7 percent among women and 10.9 percent among men. Gender gap was -0.8 percentages points.

Further, the data indicated that the prevalence of overweight in Punjab had come down in last one decade from 37.5 percent to 31 percent among women and from 30.3 percent to 28 percent among men. Rural Population suffered less from the problem of obesity compared to their urban counterparts. Greater percentages of women were overweight compared to their male counterparts. However, the data show the decreasing trend over the past decade in the problem of overweight.

Anemia among Children

Anemia is most common micronutrients deficiency among children. It results from inadequate iron intake, reduced availability of dietary iron, increased need for iron, chronic blood loss, and parasitic infections. NFHS II (1998-99) and NFHS III (2005-06) rounds recorded the highest percentages of children (under 3 years) suffered from anemia. However, NFHS IV (2015-16) round recorded a healthy trend and had a decreased in percentage of children (under 5 years) with anemia (56.6 percent). The percentages of anemic children in rural areas (57.2 percent) were higher as compared to urban areas (55.7 percent).

Anemia among Adults

The prevalence of anemia among pregnant women in Punjab has increased with time. The data presented in Table 6 indicate that 37.1percent pregnant women suffered from anemia during IInd round of NFHS. It increased to 41.6 and 42.0 percent respectively in the next two rounds. Anemia in rural Punjab increased up to 5.5 percent points according to NFHS IV. But urban areas recorded decrease from 42.6 to 34.7 percent during NFHS III and IV respectively.

Further Table 6 gave an overview of anemia among ever married women and men. It is evident from the data

Table 4. Nutritional status of adults (age 15-49 years) in Punjab from 2005-06 to 2015-2016

Particulars	NFHS III		NFHS IV	
	BMI*	BMI**	BMI*	BMI**
Women				
Rural	14.5	32.9	13.5	30.6
Urban	11.8	45.4	9.0	32.4
Total	13.5	37.5	11.7	31.1
Regional Gap***	-2.7	12.5	-4.5	1.8
Men				
Rural	11.2	27.4	12.3	25.0
Urban	13.2	34.1	8.9	32.1
Total	12.0	30.3	10.9	27.8
Regional Gap***	2.0	6.7	-3.4	7.1
Gender gap	-1.5	-7.2	-0.8	-3.3

**(BMI < 18.5 kg/m^2), **(BMI >25.0 kg/m^2), and ***Gaps were worked out on Percentage Points Method.*

Table 5. Prevalence of anemia among children in Punjab from 1998-99 to 2015-16

Particulars	Rural	Urban	Total	Regional Gap*
NFHS-II (Under 3 Years)	NA	NA	80.0	-
NFHS-III (Under 3 Years)	80.0	80.5	80.1	0.5
NFHS-IV (Under 5 Years)	57.2	55.7	56.6	-1.5

Gaps were worked out on Percentage Points Method.

Table 6. Prevalence of anemia among adults in Punjab (15-49 Years) from 1998-99 to 2015-16

Particulars	Rural	Urban	Total	Regional gap*
Pregnant Women				
NFHS II	NA	NA	37.1	-
NFHS III	41.0	42.6	41.6	1.6
NFHS IV	46.5	34.7	42.0	-11.8
Ever Married Women				
NFHS II	NA	NA	41.1	-
NFHS III	37.4	40.0	38.3	2.6
NFHS IV	54.4	52.3	53.5	-2.1
Ever Married Men				
NFHS III	13.8	11.1	12.6	-2.7
NFHS IV	27.1	24.1	25.9	-3

Gaps were worked out on Percentage Points Method.

that anemia among adults had increased significantly in the last decade in Punjab. Percentages of anemic ever married women and men had increased during last two decades. It was 38.3 percent among women and 12.6 percent among men during NFHS IInd round which was increased to 53.5 and 25.98 percent among them during IV round. Thus more than half of all women (53.5 percent) and one fourth of all men were anaemic in Punjab.

Micronutrients Intake of Children

Micronutrient malnutrition, that is, insufficient dietary intake of nutrients such as vitamin A, iron and iodine- affects the health and survival of more than 2 billion people worldwide. Deficiency of these three micronutrients is closely linked with childhood illness and mortality (OMNI 1996). Micronutrient deficiencies are the reason for both death and disability among the South East Asian Region (SEAR) children. According to the WHO, 1 out of 3 people in developing countries are affected by vitamin and mineral deficiencies.

NFHS III indicated that just one fifth of the children (12-35 months) had recommended intake of Vitamin-A nutrient which substantially increased to 70.6 percent during 2015-16. NFHS IV round recorded highest percentages of children (9-59 months) who were consuming recommended dose of Vitamin-A nutrient. Ruralities were slightly better placed compared to urban children. However, it was heartening to note that a significant majority (86.8 percent) population were using iodized salt and thus reducing the possibility of goiter.

Table 7. Micronutrients intake of children in Punjab

Particulars	Rural	Urban	Total
Vitamin A			
NFHS-II I(12-35 months)	18.8	25.0	21.0
NFHS-IV (9-59 months)	71.5	69.3	70.6
Iodized salt use			
DLHS-IV (2012-13)	86.1	87.8	86.8

Deficiencies in nutrition inflict long-term damage to both individuals and society. Compared with their better-fed peers, nutrition-deficient individuals are more likely to have infectious diseases such as pneumonia and tuberculosis, which lead to a higher mortality rate. In addition, nutrition-deficient individuals are less productive at work. Low productivity not only gives them low pay that traps them in a vicious circle of under-nutrition (WHO, 2012) but also brings inefficiency to the society, especially in India where labour is a major input factor for economic production (The World Bank, 2010).

CONCLUSIONS

The nutritional status of children and adults in Punjab is a matter of great concern. The state had got success to decrease the percentages of stunted and underweight among children but failed to bring down the proportion of wasting. Anemia among pregnant women, ever married women and men had increased from last two decades. Rural Punjab was suffering from anemia as compared to urban areas. Declining trend of stunted and underweight among children, underweight and overweight among men and women of Punjab were recorded which showed improvement in health indices. But rise in percentage of wasting among children and prevalence of anemia had added to the complexity related to nutrition cycle in the state.

REFERENCES

Bhargava, V.K. (2006). *Global issues for global citizens: An introduction to key development challenges*. Washington, DC: World Bank Publications.

Dewan, M. (2008). Malnutrition in women. *Studies on Home and Community Science*, *2*(1):7-10.

Government of India . (n.d.). *Economic survey* (various issues). New Delhi: Government of India.

Government of India. (n.d.). *National Family and Health Survey-I (1992-93), II (1998-99), III (2005-06), IV (2015-16)*. Ministry of Health & Family Welfare, New Delhi.

Government of Punjab. (n.d.). *Economic survey* (various issues). Chandigarh: Government of Punjab.

Gragnolati, M., Shekar, M., Gupta, M.D., Bredenkamp, C., & Lee, Y.K. (2005). *India's undernourished children: A call for reform and action*. Washington DC: World Bank Publications.

Gupta, A., & Rohde, J.E. (2004). Infant and young child undernutrition: Where lie the solutions? *Economic and Political Weekly*, *39*(49), 5213-5216.

International Food Policy Research Institute (IFPRI) (2012). *Global hunger index-The challenge of hunger, ensuring sustainable food security under land, water, and energy stresses*. Washington DC: IFPRI.

International Food Policy Research Institute (IFPRI) (2017). *Global hunger index: The inequalities of hunger*. Washington DC: IFPRI.

International Food Policy Research Institute (IFPRI) various issues. Washington DC: IFPRI.

International Institute for Population Sciences. (2012-13). *District level household and facility survey-IV*. New Delhi:Ministry of Health & Family Welfare.

Khalakdine, M. (1979). *Early child care in India*. New York: Gordon and Breach Science Publishers.

Kurian, O.C. (2017, February 23). Punjab election: More wasted children, anemic people than before in the state. *The Hindustan Times*.

Lomborg, B. (2004). *Global crises, global solutions.* London, UK: Cambridge University Press.

OMNI (Opportunities for Micronutrient Interventions). (1996). *The OMNI experience: Using global lessons to move local programs.* The United States Agency for International Development (USAID) funded project. Washington DC. Retrieved from:www.pdf.usaid.gov/pdf_docs/Pdabs931.pdf.

Sharma, M. (2012). Rural poverty in Punjab: A case study of village Shergarh. *International Journal of Social Sciences & Interdisciplinary Research*, *1(11),* 68-76.

The Planning Commission. (2013). P*ress note on poverty estimates for 2011-12*. New Delhi: Government of India.

WHO (World Health Organization). (2012). *Turing the tide of malnutrition: Responding to the challenges of the 21st century*. Geneva: World Health Organization Publication.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 555-558
DOI: 10.5958/2322-0430.2018.00111.7

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Readers Reactions towards The content Provided by the Mobile-Based Agro-Advisory Services

Harmandeep Kaur Sidhu[1] and Lavleesh Garg[2.]*

[1]Research Scholar and [2]Assistant Professor Department of Extension Education
Punjab Agricultural University, Ludhiana-141004

[*]Corresponding author's email:

Received: January 15, 2018 *Manuscript Number: NS-18-139* *Revision Accepted: March 12, 2018*

ABSTRACT
The farmer needs timely advisory service to do better farming and good returns. However, the farmer and extension gap is increasing day-to-day because of various constraints in the system. The paper depicts that most of the respondents of KVK (94 percent) and IFFCO (93 percent) had agriculture as their main occupation and belong to middle age category respectively. To cope with this gap agro advisory service is being provided by various services provider but with the service the content which is being provided to the reader also matter. Particularly, it is Comprehend or not, timely or not and another factor like these. So the study was undertaken to analyze the reader's reaction towards the content provided by the mobile-based agro advisory services provided by KVK Jalandhar and IFFCO respectively. A hundred beneficiaries were selected randomly from each district. So, in total there were 200 respondents. The result showed that two-thirds responded of KVK responded that the information is relevant to their condition whereas more than half (58 percent) of the respondents of IFFCO responded that the information is not relevant with their conditions.

Keywords
Agro Advisory, content, IFFCO, KVK, reaction, reader.

JEL Codes
C81, Q16.

INTRODUCTION

Agriculture continues to be the most important sector of the Indian economy and agriculture is a more or less a compulsion for the livelihood of millions of farmers. Land and water resources have almost reached their limits, the price of commodities are fluctuating almost every day, profits are negligible for most of the marginal and small farmers and most of all getting information is cumbersome. In present-day agriculture, soft resources like knowledge and skills are as important as hard resources like inputs, and sometimes more important The requirement of field level extension personnel is estimated to be about 1.3 -1.5 million against the present availability of about 0.1 million personnel. The mobile phone comes into the picture here. In today's world, almost everybody owns a mobile phone. This huge reach, if harnessed in agricultural extension, can change the face of agriculture altogether in a developing country like India where we have nothing to lose by using it as a medium to disseminate agricultural information in the multimodal form. Many initiatives have been taken in this regard to utilizing mobile phones by private sector (Indian Farmers Fertilizer Cooperative Limited, Nokia, Airtel, Tata Consultancy Services, etc.) and public sector (Ministry of Agriculture, Universities like Tamil Nadu Agricultural University, research institutions like Indian Council of Agricultural Research, State Governments of Haryana and Kerala, Indian Meteorological Department and others) in agricultural advisory service for agronomic practices, weather forecasts and market price (Saravanan & Bhattacharjee, 2014). For providing the agro advisory services the content also matter. Whenever communication takes place, it has some content refers to the message which constitutes the substantive part of the

communication process (Ahuja, 2001). Content is the information and experience(s) directed towards an end-user or audience. Content is "something that is to be expressed through some medium, as speech, writing or arts". Content can be delivered through different media including the internet, television, audio CDs, books, magazines, and live events, such as conferences and stage performance (Meaning of content, 2015). It should also make the reader satisfy. The farmer needs timely advisory service to do better farming and good returns. This facility lacks in providing on-demand information to the farmers when they really look for crucial advice timely (Bhaskar, 2012). Considering the importance of the readers' reaction towards the content provided by the service provider the study was conducted.

METHODOLOGY

Out of different service provider, we had selected two mobile based agro-advisory service providers namely, IFFCO and KVK's of Punjab Agricultural University, Ludhiana in Punjab. Sangrur district was selected under IFFCO and KVK Jalandhar was selected from all the KVK's of Punjab purposively, as the maximum number of mobile-based agro-advisory service receivers exist in these districts. List of beneficiaries who were getting these services was obtained from the respective organizations. Out of list provided by IFFCO and KVK Jalandhar, 100 beneficiaries were selected randomly from each district. So, in total there were 200 respondents for the present study.

RESULTS AND DISCUSSION

Socio-personal Characteristics of the Respondents

The information regarding socio-personal characteristics of selected respondents (farmers using IFFCO as well as KVK mobile based agro –advisory

Table 1. Distribution of respondents according to their socio-personal characteristics

(n_1=n_2=100)

Socio-personal	Categories	KVK respondents		IFFCO respondents	
		Frequency	Percentage	Frequency	Percentage
Age (years)	Young (21-34)	25	25.00	20	20.00
	Middle (35-48)	45	45.00	52	52.00
	Old (49-62)	30	30.00	28	28.00
Education	Illiterate	5	05.00	6	06.00
	Primary	11	11.00	6	06.00
	Middle	6	06.00	11	11.00
	Matric	32	32.00	30	30.00
	Senior Secondary	32	32.00	26	26.00
	Graduation	11	11.00	18	18.00
	Post-graduation	3	03.00	3	03.00
Main occupation	Agriculture	94	94.00	93	93.00
	Agriculture +Service	4	04.00	3	3.00
	Agriculture +Business	2	02.00	4	4.00
Operational landholding (acres)	Marginal (<2.5)	-	-	5	5.00
	Small (2.5-5.0)	39	39.00	23	23.00
	Semi-medium (5-10)	36	36.00	27	27.00
	Medium (10-25)	16	16.00	32	32.00
	Large (>25)	9	09.00	13	13.00
Mass media exposure	Low (16-24)	47	47.00	38	38.00
	Medium (25-33)	39	39.00	49	49.00
	High (34-42)	14	14.00	13	13.00
Extension contacts	Low(5-8)	12	12.00	37	37.00
	Medium (9-12)	53	53.00	49	49.00
	High (13-16)	35	35.00	14	14.00
Participation in extension activities	Low (8-13)	20	20.00	35	35.00
	Medium (14-19)	58	58.00	47	47.00
	High (20-25)	22	22.00	18	18.00

The percent exceeds 100 due to multiple responses.

services) which included age, education, operational land holding, crop rotation, mass media exposure, extension contacts and participation in extension activities was discussed and has been given in Table1.The results revealed that forty five percent of KVK respondents and more than half (52 percent) of the IFFCO respondents belong to middle age respectively. The data in Table 1 show that the respondents of KVK had gained education up to matriculation and senior secondary with the equal share (32.00 percent). Further, the Table 1 depicts that 30.00 and 26.00 percent respondents of IFFCO service provider had gained education upto matriculation and senior secondary respectively. The findings are also in line with Joshi (2010) as in study most of the respondent gained education upto matriculation.

The perusal of Table 1 showed that most of the respondents of KVK (94 percent)and IFFCO (93percent) had agriculture as their main occupation respectively. The results futher indicated that slightly less than half (47 percent) respondents of KVK service provider and 38.00 percent respondents of IFFCO service provider had low mass media exposure. The results are in line with Ganesan *et al.* (2013) as the farmers were having medium mass media exposure. The results presented in Table 1 showed that more than half (53 percent) respondents of KVK service provider and near about half (49 percent) of the respondents of IFFCO service provider had medium extension contacts. It is apparent from Table 1 that 58.00

Table 2. Distribution of the respondents according to their reactions towards the content provided by KVK service provider

Aspects	Categories	Frequency	Percentage
Comprehend	Fully comprehend	49	49.00
	Partial comprehend	24	24.00
	Not comprehend	28	28.00
Extent of practability	Fully practicable	49	49.00
	Somewhat practicable	38	38.00
	Not practicable	13	13.00
Relevant to conditions	Always	68	68.00
	Sometimes	32	32.00
	Never	0	00.0
Timeliness	Always timely	56	56.00
	Sometimes timely	44	44.00
	Never timely	0	00.00
Motivational	Highly motivational	20	20.00
	Somewhat motivational	68	68.00
	Not at all motivational	12	12.00

Table 3. Distribution of the respondents according to their reactions towards the content provided by IFFCO service provider

Aspects	Categories	Frequency	Percentage
Comprehend	Fully comprehend	27	27.00
	Partial comprehend	50	50.00
	Not comprehend	23	23.00
Extent of practability	Fully practicable	9	09.00
	Somewhat practicable	57	57.00
	Not practicable	34	34.00
Relevant to conditions	Always	12	11.00
	Sometimes	31	31.00
	Never	58	58.00
Timeliness	Always timely	7	07.00
	Sometimes timely	70	70.00
	Never timely	23	23.00
Motivational	Highly motivational	6	06.00
	Somewhat motivational	26	26.00
	Not at all motivational	69	69.00

percent of the respondents of KVK service provider had medium participation in extension activities and 47.00 percent of the respondents of IFFCO had medium participation in extension activities respectively.

The reaction of the Respondents towards the Content Provided by Service Provider

The reaction of the respondents towards the content was provided by the service providers are given in Table 2 and 3.

Reactions of the respondents towards the content provided by IFFCO service provider

The Table 2 depicts that near about half (49 percent) of the respondents reported that the content was fully comprehended. Near about half of the respondents (49 percent) responded that the content was fully practicable and vast majority respondents reported that the content was always related to the conditions (68.00 percent)and timely (56.00 percent),respectively. More than half of the respondents (68 percent) reported that the content was sometimes motivational. The results were in line with findings of Kumar *et al*. (2012)

Reactions of the respondents towards the content provided by KVK service provider

The perusal of Table 3 revealed that half of the farmers (50 percent) responded that the content was fully comprehended and more than half (57 percent) responded that it was fully practicable. Fifty-eight percent responded that the content was never related to their conditions, 70.00 percent responded that it was sometimes timely whereas 69.00 percent responded that the content was never motivational. The results are in line with Saha *et al.* (2015).

CONCLUSIONS

The Information Technology has emerged as an important tool in extension approaches to reach every farmer for development of agriculture development. As the numbers of extension officials are not going to increase to serve the farmers, there is a growing need for use of different management tools and technologies in day-today-farming. The need is not only for simple technologies but also the ones, which are farmer friendly. In other words, the mobiles and mobile-enabled applications are one such service that will go a long way in making the agro advisory to farmers more efficient and effective. The mobile-based agro advisory services should be handy service to the farmers' inefficient problem solving and protecting the crop, applying proper advice that ensures the productivity and financial gain to the farmer with the right content at right time.

REFERENCES

Ahuja, R. (2001). *Research Methods (*Pp 273-90). New Delhi: Prem Rawat Publication.

Bhaskar, G. (2012). Mobile based automated agro-advisory services (Maaas) in pests and diseases to farmers. Retrieved from http://insait.in/AIPA2012/articles/075.pdf on 1.08.2017

Ganesan, M., Karthikeyan, K., Prashant, S., & Umadikar, J. (2013). Use of mobile multimedia agricultural advisory systems by Indian farmers: Results of a survey. *Journal of Agricultural Extension and Rural Development,* 5, 89-99.

Joshi, V. (2010). *Extent of use and information needs regarding information technology among the progressive and non-progressive farmers* (Master's Thesis). Punjab Agricultural University, Ludhiana, India.

Kumar, R., Mishra, S., Kushwah, R.S., Jain, D.K., & Chauhan, S. (2012). Assessment and refinement of KMA in Tikamgarh district (M.P.). *Indian Research Journal of Extension Education, 12*, 35-38.

Meaning of content. (2015). Retrieved from https://en.wikipedia.org/wiki/Content_(media) on 25.9.2015

Saha, A., Kumar, P., & Mandal, T.K. (2015). Role and perceived quality of services of agro advisory agents in Nadia district, West Bengal. *International Journal of Farming Sciences, 5*, 230-236.

Saravanan, R., & Bhattacharjee, S. (2014). Mobile phone applications for agricultural extension in India, In Saravanan, R (Ed.). *Mobile phones for agricultural extension: Worldwide Agri innovations and promise for future* (pp. 1-2). New Delhi: New India Publishing Agency.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 559-563
DOI: 10.5958/2322-0430.2018.00112.9

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Constraints Faced by Women Entrepreneurs of Punjab

Mandeep Sharma[1] and Vipan Kumar Rampal[2]*

[1]*Assistant Professor and* [2]*Deputy Director (Training), Krishi Vigyan Kendra, Ropar, Punjab*

[*]*Corresponding author's email: mandeepsharma-hsee@pau.edu*

Received: January 15, 2018 *Manuscript Number: NS-18-143* *Revision Accepted: March 12, 2018*

ABSTRACT

Entrepreneurship is the core of economic development. It is a multi-dimensional task and essentially a creative activity. Entrepreneurship is the backbone of the economy. A large number of women are entering into entrepreneurship in some form or the other. Therefore, this study was conducted in district Ropar of Punjab state. 20 women entrepreneurs (who have already started enterprises) each from rural and urban areas and 20 future entrepreneurs each from the rural and urban areas of the district have been selected randomly. The objective was to analyze various constraints faced by women from both the groups. All these women have received different vocational trainings from Krishi Vigyan Kendra from Krishi Vigyan Kendra, Ropar. The study revealed that the women of both the areas faced the constraints of similar in nature. The percentage was definitely different but the nature of the problems was more or less the same. The basic and foremost requirement of starting a venture was the raising of funds. This has been the biggest hindrance, especially for the rural women to start their venture. Similar was the case of possessing entrepreneurial skills where the urban women entrepreneurs were much more comfortable as compared to their rural counterpart. Illiteracy has been the main cause of the various constraints which the rural women faced.

Keywords
Constraints, entrepreneurs, entrepreneurship, women.

JEL Codes
C81, Q16.

INTRODUCTION

The entrepreneur is the key factor of entrepreneurship and now women have been recognized as successful entrepreneurs as they have qualities desirable and relevant for entrepreneurship development (Meenakshi & Mahapatra, 2015). A large number of women are entering into entrepreneurship in some form orthe other. The drive to pursue entrepreneurship is due to the immense passion and certain compulsions. Entrepreneurs play an important role in the economic development of a nation. Women's skills, knowledge, talents, abilities, and desire to do something for themselves and their children or family are some of the reasons for the women to become entrepreneurs. According to World Bank, investing more in women enterprises rather in men reduces the inequalities and poverty and thereafter ensures the economic development of a nation. The government has also offered a variety of programmes for women entrepreneurs in the recent past. Different vocational training programmes are organized at Krishi Vigyan Kendras to make women self-employed, independent, empower and financial security. But, the challenges and opportunities for women entrepreneurs are growing rapidly. In India, although women constitute the majority of the total population, the entrepreneurial world still seems a male-dominated one, which exposes women entrepreneurs to often face some major constraints in running their enterprise successfully. Many women entrepreneurs are either housewives or illiterates or afresh graduate with no previous experience of running a business enterprise. As compared with Western nations, Indian women have more inhibitions towards entrepreneurship (Ghosh & Roy, 1997).These features have made their job more difficult. With changing time in the globalized and competitive era, women entrepreneurs are now confronted with many barriers which have often prevented them to develop their enterprises. The problems and constraints experienced by women

enterprise have thus resulted in restricting and inhibited the expansion of women entrepreneurship. In the context of the above view, an attempt has been made to analyze various constraints faced by the women entrepreneurs in respect of starting an enterprise and running an enterprise in Punjab.

METHODOLOGY

Locale and Sampling: The study was conducted in district Ropar of Punjab state. 20 women entrepreneurs (who have already started enterprises) each from rural and urban areas and 20 future entrepreneurs each from the rural and urban areas of Ropar district have been selected randomly. Total 80 women were selected for the study. All these women have received different vocational trainings from Krishi Vigyan Kendra, Ropar.

Collection of Data: The data were collected by interviewing the women entrepreneurs (who have already started enterprises) and future entrepreneurs personally with the help of structured interview schedule.

Analysis of Data: The data were tabulated on the master sheets for further processing and analyzed in frequencies and percentages.

RESULTS AND DISCUSSION

Constraints faced by future entrepreneurs: The study elicited a number of problems which were faced by the women entrepreneurs in the urban and rural background. Although they hailed from different backgrounds and family setups, still the problems which they faced were not very different from each other. The present study highlights various barriers and obstacles which these women entrepreneurs faced while initiating and running their enterprises. This is illustrated in Table 1.One of the important problems which women entrepreneurs face in the study region was of raising the funds for the initiation of their venture. This problem was more prominent among (85.00 percent) rural women future entrepreneurs as they lacked information relating to the banks and financial organizations that could help them in initiating enterprises. They have to arrange for funds to start the business by borrowing or taking the loan. The savings which they have is often insufficient to start the venture. On the contrary, less than 50 per cent of the women from urban area. In their case, education played an important role in making the women aware of the facilities provided by the banks and the government for their benefit.

Lack of awareness (55.00 percent) and adequate knowledge (72.50 percent) of the work or the related activities is another obstacle which is often faced by the women in smooth functioning of various activities in their future venture. They need to upgrade themselves from time to time by attending training programs or workshops to enhance their knowledge.

The majority of women future entrepreneurs both in urban as well as rural areas (77.50 percent) have lacked the entrepreneurial skills relating to administration, marketing, accounts, public relations etc. The proportion of such women is much higher amongst the rural women (90.00 percent) as against their urban counterpart (65.00 percent).The reason for this was the lack of education amongst the rural women in comparison to the urban women.

The majority of women both in urban as well as rural areas have faced problems relating to lack of self-confidence. The proportion of women with lack of self – confidence accounted to around 52.00 percent. The proportion of such women is much higher amongst the rural areas (80.00 percent) as against their urban counterpart (35.00 percent). Confidence to step out of the four walls of the house is an important aspect which the women entrepreneur needs to possess. Her confidence level makes her start the business venture. A constant fear of failure in doing justice to their venture and at the same time managing the family with equal sincerity and dedication often puts tremendous pressure on women entrepreneurs thus affecting their efficiency and zeal to perform. This insecurity is further aggregated because of insufficient support from the family (42.50 percent) which they face at many places. The family support was

Table 1. Constraints faced by future entrepreneurs

n= 40

Constraints	Urban		Rural		Total	
	Number	Percent*	Number	Percent*	Number	Percent*
Raising capital	9	45.00	17	85.00	26	65.00
Lack of awareness	10	50.00	12	60.00	22	55.00
Lack of knowledge	14	70.00	15	75.00	29	72.50
Lack of entrepreneurship skill	13	65.00	18	90.00	31	77.50
Lack of self-confidence	7	35.00	14	80.00	21	52.50
Lack of family support	6	30.00	11	55.00	17	42.50
Gender biasness	8	40.00	20	100.00	28	70.00
Lack of computer education	3	15.00	6	30.00	9	22.50
Lack of proper advice and guidance	12	60.00	16	80.00	28	70.00
Lack of adequate premises	13	65.00	18	90.00	31	77.50
No obstacles	2	10.00	1	5.00	3	7.50

Multiple responses.

an important reason for many women to avoid stepping into the entrepreneurial venture. Kumbhar & Kumbhar (2011) also discuss several problems faced by women future entrepreneurs like start-up finance, access to technology, management, and marketing skills and lack of confidence.

Gender biasness (70.00 percent) have always been a big obstacle in the path of the women entrepreneurship. There has been biasness in our society for years infinite relating to the issues concerned with women. The women entrepreneurs till date are a victim to gender biasness. Computer literacy (22.50 percent) was also one of the important obstacles which were faced by the women of the district which they said could have helped them in smooth functioning of various activities in their venture.

Lack of proper guidance and advice to initiate and move ahead in their entrepreneurial venture was seen more among rural women (80.00 percent) in comparison to the urban women (60.00 percent). The higher illiteracy level among rural women and lack of time among the urban entrepreneurs could be the reasons for this. The women often felt reluctant or hesitant to approach people for further direction and guidance. At times, they were also unaware of whom to approach to seek right guidance. There are a number of government institutions present both in the urban and rural regions who are ready to provide entrepreneurial guidance. These women were not aware and at times were not confident of approaching them.

A substantial number of women 77.50 percent were those who faced an obstacle of proper/adequate premises or space to initiate their business. They did not have sufficient funds to hire the premises and at home, there was no vacant space to start the venture.

There were hardly few women (7.50 percent) in both the backgrounds who did not face any obstacle while starting a venture. They had full support from their family, no worry about funds and someone to guide and help them in establishing and growing their entrepreneurial venture.

Constraints faced by future entrepreneurs: A number of obstacles or constraints arise before the women entrepreneur when she steps in the competitive world. Facing them bravely and then starting her own business is commendable on her part. As the business proceeds, she comes across several other obstacles which slower her process of work and often demoralize her. It is observed that women entrepreneurs not only face problems while initiating a venture but continue to do so once they start functioning. There is a difference in the constraints and the problems which they face before entering into a venture and the problems which they face later. The problems which the woman entrepreneurs, who were running their processing business, boutiques, beauty parlours, knitting and quilting shops, creches, general stores, etc. face in running their enterprises have been discussed in Table 2. The most important problem which any woman entrepreneur faces is the arrangement of adequate finance. Around 80.00 percent of women entrepreneurs have struggled in the district to arrange adequate finance to run their enterprises. The scarcity of working capital is noticed more among rural women entrepreneurs (90.00 percent) as compared to their urban counterpart (70.00 percent).

Managing the household is much different from administering the business activities. More than half (52.50 percent) of women entrepreneurs in the district are reported to lack the necessary administrative skills to run their enterprises. The proportion of such entrepreneurs is much higher among rural women (60.00 percent) as compared to urban women (45.00 percent).

Around 35.00 percent of women entrepreneurs in the district were reported to lack the necessary spouse/ family

Table 2. Constraints faced by old entrepreneurs

n= 40

Constraints	Urban		Rural		Total	
	Number	Percent	Number	Percent	Number	Percent*
Finance	14	70.00	18	90.00	32	80.00
Lack of administrative skill	9	45.00	12	60.00	21	52.50
Lack of spouse/family support	6	30.00	8	40.00	14	35.00
Dealing with male encounter parts	6	30.00	14	70.00	20	50.00
Mental and physical stress	20	100.00	20	100.00	40	100.00
Tough competition	18	90.00	19	95.00	37	92.50
The high cost of raw material	17	85.00	20	100.00	37	92.50
Marketing problem	16	80.00	19	95.00	35	87.50
Lack of decision making	13	65.00	17	85.00	30	75.00
Fear of failure	7	35.00	9	45.00	16	40.00
Lack of awareness about the government schemes	9	45.00	17	85.00	26	65.00
Lack of balance between social and professional life	8	40.00	15	75.00	23	57.50

**Percent exceeds 100 due to multiple responses.*

support to run their enterprises. Spouse/family support is of utmost importance for the women entrepreneurs in order to position them. Balancing the business activities with the household responsibilities is only possible for a woman entrepreneur with the family support.

Dealing with the male counterpart during the various dealings whether it is sales, purchase, marketing or any other business activity is not easy. As it is a man's world, the men find it difficult to accept a lady as their boss or accept the proposal which she gives. The ladies here, have to be perfect in their ideas and work so that they do not face any non-acceptance from the males. At times even if they have better ideas still they face rejection from their male counterparts for no valid reason at all. The men could not accept the women to stand before them and compete. To our surprise, around 70.00 percent of rural women and 30.00 percent of urban women entrepreneurs in the district have often faced non-acceptance from their male counterparts. According to these women entrepreneurs, the males were not ready to accept the females to stand before them and work on similar lines. Business deals, material supply, order for products etc. were all affected when it comes to a women entrepreneur.

It is observed during the study that mental and physical stress was an issue of and concern for women entrepreneurs. It is really disheartening to observe that all the women entrepreneurs in the district often confronted with the problem of mental and physical fatigue & stress while running their enterprises. Health is such a thing which can affect the working of any person, be it a male or a female. The women entrepreneurs who need to take care of dual responsibilities of their business and the household are often affected by ill health. Their health is very important for their business as well as the household. A woman when sick is not able to do justice to her business and is often irritated by petty things. The business suffers and so does the house. Entrepreneurial activities which require them to be always on the move often result in fatigue and stress. Physical stress in managing and coordinating with the day to day activities often lowers the output and quality of these women. They not only faced physical stress but also go through mental pressure to maintain a balance between work and family life. Lathwal (2011) identifies the major problems of women entrepreneurs in Delhi. He concluded that a majority of women belonged to business families and business environment helped them to get prepared mentally.

Competition is another important obstacle which is faced by the women entrepreneurs. Around 95.00percent of rural women entrepreneurs and 90.00 percent of urban women have struggled to counter tough competition in the market. Around 92.50 percent of women entrepreneurs in the district has faced the problem of high cost of production while running their enterprises.

Another important factor which is connected to the location of the premises is the marketing of the product. This is inter-related to the location of the enterprise. If the working place or the production unit is far away in the outskirts of the city, the woman entrepreneurs are definitely going to face marketing problems. The delivery of the product to the customers, the meetings with the clients etc. all will be not easy. Another side of the marketing problem of the women entrepreneurs is the lack of knowledge of strategies which could ease to market the product. The questions which women entrepreneurs are unable to handle are, Where to sell? Who to sell and How to sell?? These questions often hinder the best of products to be marketed. As many as 87.50 percent of women entrepreneurs are found suffering from the marketing problem of their product/service.

Any enterprise, how big or small it may be, its success and growth depends on timely and appropriate decision-making process involved in running it. It is, in fact, discouraging to observe that around 85.00 percent of rural and 65.00 percent of urban women entrepreneurs have failed to involve themselves in suitable decision-making process while running their enterprises. This clearly reflects that most of these women entrepreneurs lack insight and therefore are not able to take appropriate and timely business decisions.

Constant fear of failure (40.00 percent) in running an enterprise is another obstacle which has often troubled women entrepreneurs. There is a tremendous pressure as these women entrepreneurs enter into entrepreneurship against all odds. The survival of all internal as well as external pressures becomes a very difficult proposition and often develops a fear of failure among such women entrepreneurs.

It is really astonishing to observe that more than half of the women entrepreneurs (65.00 percent) in the district have reported being unaware of various government schemes. The problem seems more severe among rural women entrepreneurs (85.00 percent)as compared to urban entrepreneurs (45.00 percent). This is really a setback for the institutional efforts to promote women entrepreneurship for their socio-economic upliftment.

Managing time between their family and the work is also another important factor which becomes difficult for the women. Around 57.50 percent of women entrepreneurs in the district are reported to struggle to maintain a work-life balance. In the initial months, the venture requires more attention and time of the entrepreneur. The women entrepreneurs have to make a stand in the market and position themselves. This often requires late hours of working and concentration at work. The women have to take care of their household responsibilities also and at times find it difficult to make a choice. Some women were staying in joint families and have to fulfill their duty towards the elders of the family also. Work-life balance is of utmost importance for the women who have to balance between their family and the work place.

Kumbhar (2013) discusses the challenges faced by

women entrepreneurs in rural India. Lack of balance between family and career obligations, lack of freedom to make financial decisions, absence of direct ownership of the property, lack of awareness of various operational aspects and capacities, low ability to bear risk, dealing with male workers, being non-familiar with financial institutions, lack of self-confidence, lack of professional education, mobility constraints and lack of interactions with externalities are major problems of women entrepreneurship development in India.

CONCLUSIONS

The study has helped us to understand the innumerable constraints which the women entrepreneurs and future women entrepreneurs of research area have faced. As it is mentioned above they were broadly categorized into two parts. The problems while initiating the venture and the problems while running a business. The women of both the areas faced the constraints of similar nature. The percentage was definitely different but the nature of the problem was more or less the same. The basic and foremost requirement of starting a venture is the raising of funds. This has been the biggest hindrance for the rural women to start their venture. Similar was the case of possessing entrepreneurial skills where the urban women entrepreneurs were much more comfortable as compared to their rural counterpart. Illiteracy has been the main cause of the various constraints which the rural women faced. Low confidence level and poor communication skills are some of the aspects which need to be improved and polished in the rural women entrepreneurs. The rural women were fortunate to enjoy family support as they basically hailed from joint and large families. The study elicited that there was a similarity in the constraints faced by the women entrepreneurs of both the areas while running a business. The problem of finance being the foremost and competition being the second on the list. Cut-throat competition in the urban market was seen at a higher level along with poor family/spouse support. The rural women entrepreneurs faced the issue of expertise and decision making. They were not exposed to any kind of technical training program, neither was aware of the government schemes which would have helped them in their venture. It is important to create awareness amongst the rural women about the different training programs run by the different institutes of the government. They also need to be guided and advised at regular intervals for the smooth functioning of their enterprise.

REFERENCES

Ghosh, R.N., & Roy, K.C. (1997).The changing status of women in India: Impact of urbanization and development. *International Journal of Social Economics*, *24*(7-9), 902-917.

Kumbhar, A., & Kumbhar, D. (2011). Problems and prospects of women entrepreneurs in India. *Global Economic Research*, *1*(1), 151-159.

Kumbhar, V. (2013), Some critical issues of women entrepreneurship in rural India. *European Academic Research*., *1*(2), 185-192.

Lathwal, S. (2011). Women entrepreneurs in India, *International Journal of Research in IT and Management*, *1*(3), 115-139.

Meenakshi., & Mahapatra, S.N. (2015). Constraints faced by women entrepreneurs. *International Journal of Management, 6*(5),8-17

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 564-568
DOI: 10.5958/2322-0430.2018.00113.0

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Exploring the Farmer`s Attitude towards Paddy Straw Burning in Punjab

Taptej Singh[1], Narinder Deep Singh[2] and Amritpal Kaur[3]*

[1]*Deputy Project Director, Agricultural Technology Management Agency (ATMA), Moga-142001*
[2]*Assistant Professor, Department of Agriculture, Khalsa College, Amritsar-143002*
[3]*Assistant Professor, Department of Economics, GGN Khalsa College, Ludhiana-141001*

[*]*Corresponding author's email: amrtptz@gmail.com*

Received: December 31, 2017 *Manuscript Number: NS-18-62* *Revision Accepted: February 15, 2018*

ABSTRACT
The present paper aimed to explore the farmer`s attitude towards paddy straw burning in Punjab and outline the important problems arises on paddy straw management. The study was conducted in Moga district of Punjab. The study revealed that most of the respondents were literate and having farming experience of more than 10 years. Three-fourth of the total respondents surveyed were having the marginal and small land holdings with annual income up to ₹2 lakhs which confine their approach from the cost-intensive farm machinery. The existing trend of paddy straw management includes the animal feed, in situ burning and fuel purposes, whereas, most of the farmers aware regarding its use in mushroom production, mulching material, thatching, it situ incorporation and use of happy seeder/zero tillage. The main problems accounted in paddy straw management were cost and labour intensive, no government support and less palatable by dairy cattle as compared to wheat straw.

Keywords
Adoption process, attitude, behavioural profile, paddy straw burning.

JEL Codes
Q10, Q15, Q24, Q53.

INTRODUCTION

RICE (Oryza sativa)–wheat (*Triticum aestivum*) cropping system has a long history in Asia. This cropping system has been practiced in Asia (China) since AD 700. In the Indian subcontinent, states like Uttar Pradesh (UP; India)have practiced this cropping system since 1872, and Punjab(Pakistan and India) and Bengal (India and Bangladesh)since 1920. Rice and wheat are currently grown in rotation on almost 26 million hectares (m ha) in South and East Asia. Rice-wheat system (RWS) occupies nearly one-fifthof the total area under these crops. The RWS is one of the widely practised cropping systems in India and covers about 9.5 m ha, about 90percent of this area is concentrated in the Indo-Gangetic Plains (IGP) (Pal *et al.,* 2002; Hobbs & Morris, 2002; Ladha *et al.,* 2000; Janaiah & Hossain, 2003; Gupta *et al.,* 2004).

India is an agrarian country and generates a large quantity of agricultural wastes. This amount will increase in future as with growing population there is a need to increase the productivity also. Agricultural residues are the biomass leftin the field after harvesting of the economic components i.e., grain. Large quantities of crop residues are generated very year, in the form of cereal straws, woody stalks, and sugarcane leaves/tops during harvest periods. Processing of farm produce through milling also produces large amount of residues. These residues are used as animal feed, that ching for rural homes, residential cooking fuel and industrial fuel. However, a large portion of the crop residues is not utilized and left in the fields. The disposal of such a large amount of crop residues is a major challenge. To clear the field rapidly and inexpensively and allow tillage practices to proceed unimpeded by residual crop material, the crop residues are burned *in situ.* Farmers opt for burning because it is a quick and easy way to manage the large quantities ofcrop residues and prepare the field for the next crop well in time (Jain *et al.,* 2014).

Burning of agricultural residues causes gaseous

emission of 70percent CO_2, 7percent CO, 0.66percent CH_4, and2.09percent N_2O (Gupta *et al.,* 2004)and large proportion of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) and particulate matter like elemental carbon at a rate far different from that observed in forest fire due to different chemical composition of the crop residues and burning conditions (Zhang *et al.*, 2011, Mittal *et al.*, 2009).The field burning of agricultural residues is a major contributor to reduced air quality(particulates, greenhouse gases), and impacts human and animal health both medically, and by traumatic road accidents due to restricted visibility in North-Western India. Besides, burning of agricultural residues leads to a loss of organic matter and precious nutrients, especially N and S. The peak in asthmatic patients in hospitals in NW India coincides with the annual burning of rice residue in surrounding fields (Singh *et al*. 2010; Singh & Sidhu, 2014).

Research experiments indicate that retention of rice stubble adds nutrients to the soil and would reduce N requirement of the wheat crop by 10 percent (26.5 kg of urea/ha) in 5th year of stubble retention and by 15 percent (40 kg of urea/ha) from 10th year onwards. Losses to the tune of 63 thousand tonnes of N and 37 thousand tonnes of K caused by burning can be saved by adopting paddy residue management practices on the rice grown area (Singh *et al.,* 2008; Sidhu *et al.,* 2010).

Thus, paddy straw is of huge importance to the farmers and the farm. Therefore, this paper tries to explore the farmer's attitude regarding the paddy straw burning in Punjab and the awareness among the farmers in the state regarding various alternatives of paddy straw management.

METHODOLOGY

The study was conducted in Moga district of Punjab. A random sample of 40 farmers was taken from cluster of villages chosen from the each of the two blocks of Moga district namely Moga-I and Moga-II. Thus, the total of 80 farmers was selected for the study. In order to accomplish the objectives, well-structured and pre-tested questionnaire was used to collect the data personally by visiting the study area and interviewing the respondents. Proper precautions were taken to ensure unbiased response of the respondents by providing them necessary instructions after explaining the objectives of the study. The data pertaining to the agricultural year 2016-17 were taken for the present study. Suitable and appropriate scales developed by past researchers were used for the measurement of the variables in light of the derived objectives. The data so collected was analyzed by using simple tools such as percentages, averages, etc.

RESULTS AND DISCUSSION

Socio-economic Characteristics

The perusal of the Table 1 gives the descriptive idea regarding the socio-economic profile of the respondents. The age profile showed that among the respondents, about 51.25 percent i.e. half of them were belong to the middle age group i.e. 30 to50 years of age, followed by the young age group having 32.50 percent of respondents.

Among the education level, only 11.25 percent of the respondents were illiterate and 60.00 percent of them were educated up to matriculation level. Therefore, it is concluded that most of the respondents were literate, however, only 6.25 percent of the total respondents were educated above the graduate level. The degree of farming experience helps to make farming decisions and look after the risks and uncertainties of the agriculture. Among the respondents, 78.75 percent farmers were having the farming experience of more than 10 years.

Further, the size of land holding plays important role in the profitability of the farming operations and implementation of farm machinery in the field, but as resembling the state`s scenario, 70.00 percent of the total respondents surveyed were having the marginal and small land holdings which confine their approach from the cost-intensive farm machinery. The annual income of the respondents further supports the above explanation that 58.75 percent of the respondents were having annual income of up to ₹2 lakhs.

Extension Approach and Behavior

Extension approach and behavioural profile of the respondents portrays the various aspects or components which affects the adoption process among the society. The adoption process is the mental progression through which an individual pass from first hearing of an innovation to its final adoption, while adoption is a decision to continue the full use of an innovation. It is apparent from the results presented in Table 2 that, more than two-fifths (42.50percent) of the respondents had medium level of extension contact, followed by 32.50and 23.75 percent had low and very low level of extension contact, respectively. Only, 3.75 and 1.25 percent of respondents had high and very high level of extension contact, respectively.

Further, 62.50 percent of the respondents had the medium to very high level of mass media exposure and 51.25 percent had the scientific orientation of the work done in the agricultural field. In lieu of this, only 33.75 percent of the respondents had the high and very high level of knowledge regarding the new technologies and methods and only 32.50 percent of the respondents had favourable and most favourable attitude to adopt such technologies and methods.

Paddy Straw Management

The perusal of the Table 3 represents the existing trend of paddy straw management in Punjab state. In the state, the operational land holding of the farmers being marginal and small, but mechanical harvesting of paddy with the help of combine has been most prevalent and thereby it resulted in the presence of long stubbles in the field. Therefore, the farmers required extra efforts or expenses to prepare the field for the next crop andhence,77.50 percent of the sampled respondents done

Table 1. Socio-economic profile of the respondents

Components	Categories	Frequency (No.)	Percent (Percent)
Age	Young (Up to 30 years)	26	32.50
	Middle (30-50 years)	41	51.25
	Old (Above 50 years)	13	16.25
	Total	80	100.00
Education	Illiterate	09	11.25
	Primary	21	26.25
	Matriculation	27	33.75
	Senior secondary	18	22.50
	Graduate	03	3.75
	Post-graduate and above	02	2.50
	Total	80	100.00
Farming experience	Low (Up to 10 years)	17	21.25
	Medium (11 to 20 years)	35	43.75
	High (Above 20 years)	28	35.00
	Total	80	100.00
Land holding	Marginal (Up to 1.0 ha)	23	28.75
	Small(1.0 to 2.0 ha)	33	41.25
	Medium (2.0 to 4.0 ha)	15	18.75
	Large (Above 4.0 ha)	09	11.25
	Total	80	100.00
Annual income	Up to ₹1 lakh	06	7.50
	₹1,00,001 to ₹2,00,000 lakh	41	51.25
	₹2,00,001 to ₹3,00,000 lakh	18	22.50
	Above ₹3 lakh	15	18.75
	Total	80	100.00

Table 2. Extension approach and behavioural profile of the respondents

(Percent)

Response scale	Components of extension approach and behavior (n=80)				
	Extension contact	Mass media exposure	Scientific orientation	Knowledge	Attitude*
Very low/Most unfavourable	23.75	3.75	2.50	11.25	8.75
Low/Unfavourable	32.50	33.75	13.75	16.25	13.75
Medium/Neutral	42.50	51.25	32.50	38.75	45.00
High/Favourable	3.75	8.75	46.25	27.50	23.75
Very high/Most favourable	1.25	2.50	5.00	6.25	8.75
Total	100.00	100.00	100.00	100.00	100.00

Attitude is measured on most unfavourable to most favourable response scale.

the burning of paddy straw in the field. Almost all of the respondents were used the proportion of the paddy straw in the animal feed, but the wheat straw is more preferred over the paddy straw as animal feed as it reduced milk yield in milch animals due to the presence of high silica content in paddy straw which makes it unpalatable. Apart from various utilities, it was also observed that 65.00 percent of farmers used paddy straw for fuel purposes to save the high cost of LPG gas and reduce their expenses.

Almost half of the farmers i.e. 48.75 percent used or supplied paddy straw for mushroom production which was found to provide additional income to the rural households and employment opportunities to the rural women. However, more than half of the respondents that is 56.25 and 51.25 percent were managing the paddy straw by using happy seeder/zero tillage and thatching it for further use. Whereas, the smaller proportion of the respondents used or manage the paddy straw as mulching material (21.25 percent), compost making (20.00 percent), incorporating in the field (16.25 percent) and packing material (16.25 percent).

The perusal of the Table 4 represents the awareness among farmers regarding various alternatives of paddy straw management in Punjab. The results revealed that all

the farmers were aware about the management of paddy straw as animal feed, thatching, in situ incorporation and happy seeder/zero tillage. Nearly 90.00 percent of them were aware about the use of paddy straw in mulching material followed by 83.75, 81.25 and 71.25 percent of them who knewabout the use of paddy straw in mushroom production, as fuel purpose and in compost making, respectively.

Almost, one-fifth of the respondents were aware about the use of paddy straw in packing material (23.75 percent) and paper mill industry (18.75 percent). Only 13.75 and 6.25 percent of them were aware about the use of paddy straw for biogas production and bio-energy, respectively.

Table 3. Existing trend of paddy straw management in Punjab

(Multiple Response)

Activities regarding paddy straw management	Frequency (No.)	Percent
Burning	62	77.50
Mulch materials	17	21.25
Animal feed	80	100.00
Compost making	16	20.00
Mushroom production	39	48.75
Happy seeder/Zero tillage	45	56.25
Incorporation	13	16.25
Thatching/storing	41	51.25
Packing material	13	16.25
Fuel purpose	52	65.00

Table 4. Awareness among farmers regarding various alternatives of paddy straw management in Punjab

(Multiple Response)

Particulars	Frequency (No.)	Percent
Bio-energy	05	6.25
Biogas production	11	13.75
Animal feed	80	100.00
Mulching material	72	90.00
Mushroom production	67	83.75
Thatching/storing	80	100.00
Paper mill industry	15	18.75
Compost making	57	71.25
Fuel purpose	65	81.25
Packing material	19	23.75
Incorporation	80	100.00
Happy seeder/Zero tillage	80	100.00

Problems in Paddy Straw Management

The problems faced by the respondents in paddy straw management were presented under the various heads namely, technical problems, management problems, financial problems and problems in domestic use (Table 5). The results revealed that although many alternatives were accessible but not adopted by the farmers for paddy straw management. As perceived by the respondents, these alternative techniques were either not suitable or economically feasible for them.

From technical problems, all the farmers were reported that increased use of combine harvester for crops leading to long stubbles in the field. Other noteworthy

Table 5. Problems faced by farmers in paddy straw management in Punjab

(Multiple Response)

Particulars	Frequency (No.)	Percent
Technical problems		
Non availability of suitable technologies	73	91.25
Increased use of combine harvester for crops leading to long stubbles in the field	80	100.00
Crop residues interfere with tillage operation	76	95.00
Crop residues interfere with seeding operation for the next season crop	79	98.75
Management problems		
Non availability of labour to manage paddy straw	80	100.00
Except burning, other alternatives delays wheat sowing	75	93.75
Transportation is laborious	71	88.75
Financial problems		
High cost involved in straw removing from the field	80	100.00
High labour wages	76	95.00
Transportation cost is high	66	82.50
Insufficient government support	78	97.50
Problems in Domestic use		
Paddy straw is less palatable than wheat straw	80	100.00
Feeding of paddystraw reduces milk yield	63	78.75
Poor fuel at higher temperature	65	81.25
Paddy residue has no local economic use	71	88.75

problems among paddy straw management were crop residues interfere with seeding operation for the next season crop (98.75 percent) and crop residue interfere with tillage operations (95.00 percent). Non-availability of suitable technologies was also reported as problem by 91.25 percent of the respondents. Among management problems, the main problem comes out to be non-availability of labour to manage paddy straw, which was reported by cent percent of the respondents. Other problems come under this head was except burning, other alternatives of paddy straw management delays wheat sowing (93.75 percent) and transportation of the paddy straw is labour intensive (88.75 percent).

Among financial problems, the high cost involved in straw removing operations from the field was the main problem reported by cent percent of the respondents. Other problems reported were insufficient government support (97.50 percent), high labour wages (95.00 percent) and transportation cost is high (82.50 percent). Problems accounted while domestic use of the paddy straw was also the main reason for burning of the residue. The main problem arises during domestic use of paddy straw was its less palatability by dairy cattle as compared to the wheat straw. Other problems accounted was no local economic use (88.75 percent), poor fuel (81.25 percent) and feeding of paddy straw reduces milk yield (78.75 percent).

CONCLUSIONS

The above discussion on exploring the farmer`s attitude towards paddy straw burning in Punjab and outline the important problems arises on paddy straw management culminate to some specific conclusions that under the present agricultural situation of Punjab, where farmers are not willing to shift from prevailing rice-wheat system, the problem of paddy straw burning continues as there was no government support, paddy straw management was cost intensive and laborious, except in situ burning of paddy straw alternate operations delays the wheat sowing and furthermore affects the preceding crop yield by interfering the tillage and seeding operations. So, there is need to give attention on financial support given by the government on paddy straw management and moreover the infrastructural facilities and awareness to decrease the in situ paddy straw burning.

REFERENCES

Gupta, P.K., Sahai, S., Singh, N., Dixit, C.K., Singh, D.P., Sharma, C., ...Garg, S.C. (2004). Residue burning in rice-wheat cropping system: Causes and implications. *Current Science, 87,*1713-1717.

Hobbs, P.R., & Morris, M.L. (2002). *Meetings South Asia's future food requirements from rice-wheat cropping systems: Priorities issues facing researchers in the post green revolution era*. NRG Paper 96-01. CIMMYT, Mexico.

Jain, N., Bhatia, A., & Pathak, H. (2014). Emission of air pollutants from crop residue burning in India. *Aerosol and Air Quality Research, 14,* 422-430.

Janaiah, A., & Hossain, M. (2003, March). Farm-level sustainability of intensive rice-wheat system: socio-economic and policy perspectives. Addressing Resource Conservation Issues in Rice-Wheat Systems of South Asia. A Resource Book, Rice-Wheat Consortium for Indo-Gangetic Plains (CIMMYT).

Ladha, J.K., Fischer, K.S., Hossan, M., Hobbs, P.R., & Hardy, B. (2000). *Improving the productivity and sustainability of rice-wheat systems of the Indo-Gangetic plains: A synthesis of NARS–IRRI partnership research.* IRRI Discussion Paper Ser. 40, IRRI, LosBanos, Philippines.

Mittal, S.K., Susheel, K., Singh, N., Agarwal, R., Awasthi, A., & Gupta, P.K. (2009). Ambient air quality during wheat and rice crop stubble burning episodes in Patiala. *Atmospheric Environment, 43,* 238–244.

Pal, S.S., Jat, M.L., Sharma, S.K., & Yadav, R.L. (2002). Project Directorate for Cropping System Research. Meerut: ICAR, Modipuram.

Sidhu, R.S., Vatta, K., & Dhaliwal, H.S. (2010). Conservation agriculture in Punjab: Economic implications of technologies and practices. *Indian Journal of Agricultural Economics, 65*, 413-427

Singh, R.P., Dhaliwal, H.S., Singh, T., Sidhu, H.S., Singh, M., Singh, Y., & Humphreys, E. (2008). A financial assessment of the happy seeder for rice-wheat systems in Punjab, India. In: Humphreys, E. & Roth, C.H. (Eds.). *Permanent beds and rice-residue management for rice-wheat systems in the Indo-Gangetic plain.* ACIAR Proceedings No. 127, Australian Centre for International Agricultural Research, Canberra, Australia, 182-190.

Singh, Y., Gupta R.K., Singh, J., Singh,G., Singh G., & Ladha J.K. (2010). Placement effects on rice residue decomposition and nutrient dynamics on two soiltypes during wheat cropping in rice-wheat system in north western India. *Nutrient Cycling in Agroecosystems, 88,*471-480.

Singh, Y., & Sidhu, H.S. (2014). Management of cereal crop residues for sustainable rice-wheat production system in the Indo-Gangetic plains of India. *Proceedings of Indian National Science Academy, 80,* 95-114.

Zhang, H., Hu, D., Chen, J., Ye, X., Wang, S.X., Hao, J., Wang, L., Zhang, R.,& Zhisheng, A., (2011). Particle size distribution and polycyclic aromatic hydrocarbons emissions from agricultural crop residue burning. *Environmental Science and Technology, 45,* 5477–5482.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 569-573
DOI: 10.5958/2322-0430.2018.00114.2

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Utilization of Information Sources by Bt Cotton Farmers in Punjab

Jagmit Singh[1] and Dharminder Singh[2]*

[1]*Research Scholar and* [2]*Extension Specialist, Department of Extension Education*
Punjab Agricultural University, Ludhiana-141004

[*]*Corresponding author's email: iamjagmitbrar@gmail.com*

Received: December 31, 2017 *Manuscript Number: NS-18-70* *Revision Accepted: February 24, 2018*

ABSTRACT

Scientific Farm information is a crucial non-monetary input for realizing potential productivity of the crops. The present study was conducted to analyze the utilization of information sources by Bt cotton farmers in Punjab state. A total 150 cotton farmers were selected from three major cotton growing districts of the Punjab state. It was found that most of the respondents were falling in the age group of 43 to 56 years and were matriculates. Nearly half of the respondents possessed the medium size of operational land holding. Majority of the respondents found to be dependent on the non-institutional sources of credit. Study revealed that among ICT tools, weather applications were the most popular for getting information on weather conditions and used by 24.00 percent of the respondents. Nearly ten percent of the respondents used other ICT applications such as WhatsApp (7.33 percent) and Facebook (11.33 percent) for seeking agricultural information. It was also found that pesticide dealers and private companies' representatives were the major sources for seeking information by respondents. Majority of the respondents (82.00 percent) were members of agricultural co-operative societies in their villages. Farm literature, TV telecast and radio broadcasts were some other information sources utilized by the Bt cotton farmers in Punjab state. It was also found that area and productivity of Bt cotton at the fields of respondents started decreasing gradually due to decreased yields, price fluctuations, leading to lower gross income of the respondents. Study suggests that the pesticide dealers and personnel of agricultural cooperative societies need to be regularly trained for providing scientific farm information to the Bt cotton farmers of the state.

Keywords
Bt Cotton, credit, farm literature, ICT, information sources, pesticide dealers.

JEL Codes
C81, Q16.

INTRODUCTION

Cotton is worldwide growing crop and important source of fibre and oils. It plays a dominant role in economy of the country and is also known as 'white gold' and 'king of fibers'. India, as a major cotton producer in the world, is having the largest area under cotton and is also the second largest consumer of cotton. India accounts for approximately one-fourth of the world's total cotton area. Mostly cotton area grown in India is under the rainfed conditions, and about a one third is grown under irrigated conditions. It contributes about 30 percent of the gross domestic product of Indian agriculture (Sundaram *et al.,* 1999). Cotton occupies an area of 118.77 lakh hectares in India with a production of 338 lakh bales in the year 2015-16. However, India`s average yield of cotton is 566 kg/ha as compared to worlds average productivity of 766 kg/ha (Cotton Corporation of India, 2017). Genetic Engineering Approval Committee (GEAC) on 26 March 2002 gave approval for Bt cotton in India for the central zone (Maharashtra, Gujarat, and Madhya Pradesh) and south zone states (Andhra Pradesh, Karnataka, and Tamil Nadu). Commercial cultivation of Bt cotton for northern zone including Punjab state was approved in the kharif season of year 2005 (Bt cotton attracting youngsters to farming in India, 2013). In India, the introduction of Bt cotton for the commercial cultivation was a major technological milestone. Since its beginning, the technology has transgressed sizes and agro-ecologies, resulting in considerable economic gains, and has transformed the landscape of Indian cotton economy (Ramasundaram *et al.,* 2014). Being a major commercial crop of India, cotton crop also

occupies an important place in agricultural scenario of Punjab. It is the main *kharif* crop of south-western districts of the state, namely Bathinda, Mansa, Fazilka, Muktsar, Faridkot, Ferozepur, Barnala,and Sangrur. In Punjab, cotton crop was cultivated on an area 420 thousand hectares with average productivity of 543 kg per hectare under irrigated conditions in the year 2014-15 (Government of Punjab, 2017).

METHODOLOGY

The Study was conducted in the three major cotton growing districts of the Punjab state viz. Bathinda, Mansa, and Fazilka. These districts were selected purposively, having their maximum area under Bt cotton cultivation. The five villages were selected from each of three districts (Bathinda, Mansa,and Fazilka) and 10 cotton farmers from each village were taken for the study. Thus, a total sample of 150 farmers from 15 villages was selected for the present study. An interview schedule was developed to collect the data from respondents. The interview schedule was pretested on 20 non sampled farmers to remove any ambiguities. Data were collected personally visiting the study area and interviewing the farmers. Proper precautions were taken to ensure unbiased response of the respondents by providing them necessary instructions after explaining the objectives of study. The data were tabulated and analyzed using appropriate statistical tools.

RESULTS AND DISCUSSION

Socio-personal Characteristics of Bt cotton Growers

The data in Table 1 indicate that age of the respondents varied from 28-70 years. More than one-third of the respondents i.e. 37.33 percent and 36.00 percent of respondents belonged to the age group of 43-56 years and 28-42 years respectively while 26.67 percent of them were in the age group of 57-70 years. It was also observed that 26.00 percent of the respondents were educated upto primary and more than one third (36.00 percent) of the respondents were matriculate.

It was also observed that 68.00 percent of the respondents had family size of 3-6 members followed by 28.00 percent of them had 7-10 members in the family. It was also found that nearly half of the respondents (48.67 percent) were having medium (4-10 ha) operational land holding. More than one fifth (22.00 percent) and 21.33 percent of the respondents had large (>10 ha) and semi-medium (2-4 ha) sized operational land holdings, respectively. While 6.67 percent of the respondents had small (1-2 ha) and very few (1.33percent) had marginal (<1 ha) operational land holding. All of the respondents used canal water as their main source of irrigation. The

Table 1. Distribution of respondents according to their socio-personal characteristics

(n=150)

Socio-personal characteristics	Category	Frequency	Percentage
Age (in years)	28 – 42	54	36.00
	43 – 56	56	37.33
	57 – 70	40	26.67
Education	Upto Primary	39	26.00
	Middle	25	16.67
	Matric	54	36.00
	Senior Secondary	20	13.33
	Graduation and above	12	8.00
Family size (members)	3 – 6 members	102	68.00
	7 – 10 members	42	28.00
	11 – 14 members	6	4.00
Operational land holding (ha)	Marginal (< 1)	2	1.33
	Small (1-2)	10	6.67
	Semi-medium (2-4)	32	21.33
	Medium (4-10 ha)	73	48.67
	Large (> 10)	33	22.00
Source of irrigation*	Electric motor	67	44.67
	Canal	150	100.00
	Diesel pump	87	58.00
Experience of cotton cultivation (Years)	10 to 24	52	34.67
	25 to 38	66	44.00
	39 to 52	32	21.33
Gross annual income (₹ lakhs)	< 12.73	87	58.00
	12.73-18.38	34	22.67
	> 18.38	29	19.33

Percent exceeds 100 due to multiple response.

data in the Table 1 also reflect that the respondents were highly experienced in cotton cultivation, as 44.00 percent of the respondents were having 25 to 38 years of cotton cultivation experience. It was also found that 58 percent of the respondents were having gross annual income less than 12.73 lakhs and 22.67 percent of them were having gross annual income ranging from 12.73 to18.38 lakhs.

Sources of Credit

Credit is required for the various purposes in agriculture. The data in Table 2 reveal the current credit status of the respondents from various sources. It was found that most of the farmers i.e. 94.00 percent were under the debt of money lenders on an average loan of 4.32 lakhs per farmer at the average rate of interest 24 percent per annum. Also, 82 percent of farmers availed credit from co-operative banks with an average of 1.39 lakh per farmer at an average rate of interest at four percent per annum. As many as 55.33 percent of farmers availed Kisan credit cards with a average loan of 8.25 lakhs per farmer with an average interest rate of 6.83 percent per annum. Only 8 percent of the respondents had taken an average loan of 2.16 lakhs from the relatives or neighbours at 24 percent rate of interest per annum. Singh *et al.* (2014) also reported that farmers face a large number of problems in availing institutional credit which drives them to fall into the debt trap of the crafty and exploitative non-institutional sources of credit.

Sources of Seeking Information

The perusal of Table 3 revealed that 60.67 percent of respondents seek information regarding Bt cotton from seed dealers/pesticide dealers/commission agents regularly whereas 37.33 percent respondents occasionally visits to them for seeking information. Slightly more than half (50.67percent) of the respondents occasionally seek information from private company representatives whereas ten percent visiting regularly. Majority of the respondents never seeks information regarding Bt cotton from PAU/KVK scientists (89.33percent) and from Agricultural Development Officers (71.33 percent). Gujar & Padaria (2012) also found that deployment of Bt cotton in India has been private oriented.

The mean score was calculated for each source by providing the score of 3, 2 and 1 for regularly, occasionally and never respectively. Thus the pesticide dealers and private company representatives had got the highest mean score of 2.58 and 1.70 respectively, which show that these were the major sources for seeking information by respondents.

Mass Media Exposure

The data in the Table 4 represent that 57.33 percent of the respondents were reading newspaper for agricultural information, whereas only 20.67 percent read agricultural magazines or Package of Practices, published by PAU. Also, 22.67 percent of the respondents were not reading any kind of literature regarding agriculture.

Study also revealed that weather applications were the most popular among the respondents for getting information on weather conditions as it was used by 24.00 percent of the respondents. Nearly ten percent of the respondents used other applications such as WhatsApp (7.33 percent) and Facebook (11.33 percent) for seeking agricultural information. About 17.00 percent of respondents used search engines like Google, Yahoo for

Table 2. Distribution of respondents according to different sources of credit availed by them

(n=150)

Categories	f*	Percent	Average loan /farmer (in lakhs)
Money lenders	141	94.00	4.32
Kisan Credit Cards (KCC)	83	55.33	8.25
Cooperative Banks	123	82.00	1.39
Relatives/Neighbours	12	08.00	2.16

Percent exceeds 100 due to multiple response.

Table 4. Distribution of respondents according to use of literature and ICT tools as a source of farm information

(n=150)

Source	Category	No.	Percent*
Literature*	Newspaper	86	57.33
	Magazine/PAU Package of Practices	31	20.67
	Do not read	34	22.67
Use of ICT Tools for agricultural	WhatsApp	11	7.33
	Facebook	17	11.33
	Weather apps	36	24.00
	Internet (Google search)	26	17.33
	SMS subscriber	3	2.00

Percent exceeds 100 due to multiple responses.

Table 3. Distribution of respondents according to sources of seeking information regarding Bt cotton

(n=150, percent*)

Source	Regularly	Occasionally	Never	Mean score
Seed dealers / Pesticide dealers/ commission agents	60.67	37.33	2.00	2.58
Company representatives	10.00	50.67	39.33	1.70
ADO	6.00	22.67	71.33	1.35
PAU/KVKs scientists	0.67	10.00	89.33	1.11

Percent exceeds 100 due to multiple responses.

searching information related to agriculture. Only two percent respondents had subscribed to SMS services for agriculture-related information. This may be because of the reason that most of the respondents were of high aged group and only matriculates, so they were not having much knowledge or skills of using various electronic gadgets like computers or smartphones.

Use of Farm Telecasts and Radio Broadcasts as a Source of Farm Information

Data shown in the Table 5, few farmers were found to be viewing the farm telecasts or listening to radio broadcasts related to agriculture either regularly or sometimes a week. It was 13.33 percent of the respondents who watch the channel *DD Kisan* Channel three to five times a week, whereas 47.33 percent watch it 1-2 times a week and about 40.00 percent never watched it. Similarly, about 10 percent of respondents watch the programme *Mera Pind Mere Khet* always, 52.00 percent watch it sometimes and 38.00 percent never watched it. Only 2 percent respondents listen to the *Dehati programme* regularly, whereas nearly about 90.00 percent of respondents never listened to these programmes. The highest mean score calculated was 1.74 for the *DD Kisan* Channel and lowest for the *Dehati Programme* (1.07).

Social Participation

The perusal of Table 6 shows the social participation status of the respondents. About 82.00 percent farmers were the members of co-operative societies. Only 3.33 percent farmers were members of panchayat and none of the farmer belonged to any farmers/youth/sports club. Most of the farmers were availing the benefits of co-operative societies for getting agricultural inputs, such as fertilizers, pesticides or farm implements at lower interest rates for short durations.

Table 6. Distribution of respondents according to their social participation

(N=150)

Membership	No.	Percent
Panchayats	5	3.33
Co-operative Society	123	82.00
No membership	22	14.67

Percent exceeds 100 due to multiple responses.

Area and Productivity of Bt Cotton Crop during the years 2005 – 2015

The results presented in Table 7 depict the change in the area under Bt cotton cultivation and average yield by the respondents during the last ten years. Out of the total operational land holdings of the respondents, area under Bt cotton was 79.06percent in the year 2005 but slightly decreased in the year 2010 to 77.23 percent and further decreased to 57.89 percent in the year 2014 and remained about 42.00 percent of the total operational land holding of respondents in the year 2015.

Similarly, average yield of Bt cotton at the fields of respondent farmers decreased from 31.91quintals per hectare in the year 2005 to 26.35 quintals per hectare in the year 2010, which later on decreased to about 20 quintals per hectare in the year 2014. The major crop failure was witnessed during 2015 due to outbreak of whitefly and caused a huge decrease in yield, leading to only 8.32 quintals per hectare in the year 2015.

Thus, it was found that Bt cotton was adopted at high rate in its initial years of arrival but later on area under Bt cotton started decreasing gradually due to decreased yields, price fluctuations, leading to lower gross incomes of the respondents. It was also reported by Kapoor *et al.* (2011). This have occurred due to various challenges

Table 5. Distribution of the respondents according to use of farm telecasts/radio broadcasts as a source of farm information

(N=150, percent*)

Sources	Always (3-5 times/week)	Sometime (1-2 times/week)	Never	Mean score
DD Kisan Channel	13.33	47.33	39.33	1.74
MeraPind Mere Khet	9.33	52.00	38.67	1.70
Dehati Programme	2.00	3.33	94.67	1.07

Percent exceeds 100 due to multiple responses.

Table 7. Area and productivity of Bt cotton cultivation in different years from 2004 to 2015

(N=150)

Year	Approx. total operational land (ha)	Area under cotton (ha)	Percentage area	Avg. yield of Bt cotton (q/ha)
2005	1418	1121.2	79.06	31.91
2010	1388	1072	77.23	26.35
2014	1214	703.4	57.89	19.98
2015	1214	510.0	42.00	8.32

faced by the Bt cotton growers and Bt cotton technology within a period of 10 years, such as attack of mealybug, sucking pests, sub-standard seeds or pesticides, etc. as reported by the respondents.

CONCLUSIONS

Scientific Farm information is a crucial non-monetary input for realizing potential productivity of the crops. Extension contacts or reliable information sources are generally known to enhance the adoption process. It is evident from the study that majority of farmers are dependent on dealers for seeking information regarding Bt cotton cultivation. Since Bt cotton technology was introduced by private companies, the farmers were mainly dependent upon seed or pesticide dealers for information. These dealers or commission agents have their vested interests to earn profit by maximizing sale of seed or pesticides rather than educating the farmers and solving their problems, unlike public extension system. Study suggests the strengthening the services of public extension system and regular training of pesticide dealers and cooperative personnel for providing scientific farm information to the Bt cotton farmers of the state.

REFERENCES

Bt cotton attracting youngsters to farming in India. (2013). Bt cotton attracting youngsters to farming in India. Retrieved from http://economictimes .indiatimes.com/news/economy/agriculture/bt-cotton-attracting-youngsters-to-farming-in-India-survey/ articleshow/27424844.cms on 17-08-15.

Cotton Corporation of India. (2017). *Area, production, and productivity of cotton in India*. Retrieved from http://cotcorp.gov.in/statistics.aspx on 24.11.2017.

Government of Punjab. (2017). *Area, yield, production, and MSP of cotton*. Retrieved from http://agripb.gov.in/home.php?page=cotto on 24.11.2017

Gujar, L.R., & Padaria, R.N. (2012). Farmer perception and constraint in adoption Bt cotton technology. *Journal of Community Mobilization and Sustainable Development, 7,* 45-49.

Kapoor, C.J., Verma, J.R., & Bhati, D.S. (2011). Bt cotton in Rajasthan: problems and prospects. *Journal of Progressive Agriculture, 2*, 33-38.

Ramasundaram, P., Suresh, A., Samuel, J., & Wankhade, S. (2014). Welfare gains from application of first generation biotechnology in Indian agriculture: The case of Bt cotton. *Agricultural Economics Research Review, 27,* 73-82

Singh, S., Bhogal, S., & Singh, R. (2014). Magnitude and determinants of indebtedness among farmers in Punjab. *Indian Journal of Agricultural Economics, 69*(2), 243-256.

Sundaram, V., Basu, A.K., Iyer, K., Narayanan, S.S., & Rajendran, T.P. (1999). *Handbook of cotton in India.* Indian Society for Cotton Improvement. Mumbai, India.

www.soed.in

Indian Journal of Economics and Development (2018) 14(1a), 574-578
DOI: 10.5958/2322-0430.2018.00115.4

NAAS Score: 4.82
www.naasindia.org
UGC Approved

Retailing of Traditional Flowers by Women and Household Livelihood Security- Evidences from two Districts of Eastern Dry Zone of Karnataka

Avinash[1], C.P. Gracy[2] and B.L. Chidananda[3]*

[1&2]*Department of Agricultural Marketing, Cooperation and Business Management*
[3]*Department of Animal Sciences, University of Agricultural Sciences, GKVK, Bengaluru-65*

[*]*Corresponding author's email: gracycp@gmail.com*

Received: December 31, 2017 *Manuscript Number: NS-18-71* *Revision Accepted: March 22, 2018*

ABSTRACT
The specific objectives of the study were to analyze factors influencing women to take up retail marketing of flowers and livelihood dependence of women on flower retailing. The sources of household income revealed that income from flower retailing comprised 76 percent (₹19574), while that of agriculture and other sources accounted for ₹1233.33, and ₹4867, respectively for respondents of Chikkaballapura. In Bengaluru, flower vending contributed about 61 percent (₹21,716), while other sources accounted for ₹14,018 (39 percent).The Purchasing Power Parity per capita (Rangarajan method) was used to compute quartile distribution of households according to monthly per capita expenditure.

Keywords
Livelihood security, purchasing power parity, traditional flowers, women.

JEL Codes
R20, R13, Q13.

INTRODUCTION

Flowers are an integral part of Indian households marking not only religious and festive occasions but also for day-to-day usage in the form of loose strings, garlands and bouquets and decorations to symbolize different moods and emotions. Today, no occasion is complete without flower arrangements and decorations. The use of flowers has come a long way to reach the present status and still has a very promising future ahead. Based on the method of production, type of planting material and capital investment, flowers are classified as open field and high-tech cultivation. On the basis of harvesting, flowers harvested with long stalks are termed as 'cut flowers', and flowers with short or no stalk are termed as 'loose flowers'. About two thirds of the area under floriculture is devoted for production of traditional flowers, which are marketed loose, for example, marigold, jasmine, chrysanthemum, crossandra, tuberose, *kakada*, China aster, rose etc. Such flowers need to be tied together for use in various decorative forms. Tying of these flowers and vending provides livelihood opportunities and supplemental income for women and families. The advancement in science, education, technology and trade have brought about paradigm shift in income, expenditure and consumption pattern. The structural adjustment produces deep social and economic restructuring at different levels of society especially at household levels. In response to this change, many households are intensifying their economic strategies in order to counterbalance fragile income sources (Oberhauser & Kobena, 2008). Structural adjustment induced coping strategies of households are aimed at the well-being of the families. Although flower vending as a profession generates daily incomes to households, it is important to quantify the adequacy of such earnings to meet consumption expenditure of the members. There are a number of conceptual approaches to the measurement of well-being. The most common approach is to measure economic welfare based on

household consumption expenditure or household income. The latest definition of poverty is based on Rangarajan panel estimates, the new poverty line work out to monthly per capita consumption expenditure of ₹972 in rural areas and ₹1,407 in urban areas in 2011-12 which amounts to₹32 per capita daily consumption expenditure in rural areas and ₹47 in urban areas (Planning Commission of India, 2014).

METHODOLOGY

The main objective of the paper is to compute costs and returns of flower retailing, livelihood security and purchasing power parity of households in urban Bengaluru and semi-urban Chikkaballapura. A total of 100 women flower retailers were randomly selected from important marketplaces of Chikkaballapura and Bengaluru city. The data pertaining to quantity of flowers handled, value addition and income contribution to livelihood security from flower vending were obtained with the help of a pre-tested structured schedule. The data were analyzed using descriptive statistics and purchasing power parity. In order to measure poverty, a poverty line has to be defined, which can be absolute or relative. An absolute poverty line is the threshold below which families or individuals are considered to be lacking the resources to meet the basic needs. It can either be defined at the national level, estimating what it means to be poor in each country's situation, or at international level. In order to make international comparison possible, the World Bank has also defined US$ 1.25 PPP (Purchasing Power Parity) per day as a rough indicator of extreme poverty. This measures the quantity of goods and services bought by an individual in any country which is comparable to the amount of goods and services that can be bought in the US for dollar 1.25. Poverty lines can, however also be determined relative to the population's mean income or consumption. In this research study the total annual per capita expenditure expressed in INR reported by the households is used as the measure of welfare and poverty analysis. The expert committee set up by the Planning Commission in 2013 under C Rangarajan, former chairperson of Prime Minister's Economic Advisory Council, has defined the new poverty line (per day per capita) as ₹32 in rural areas and ₹47 in urban areas (Planning Commission of India, 2014).

RESULTS AND DISCUSSION

Costs and Returns of Flower Retailing

The costs and returns were computed for different flower types in order to assess the net income realization from flower vending. The results of the analysis are presented separately in Tables 1 and 2 for Chikkaballapura town and Bengaluru city. It could be observed (Table 1) that the most popular flower types were *kakada*, roses, jasmine and crossandra as more than 50 percent of the respondents handled these flowers on a regular basis. The remaining six flower types viz., Nerium, China aster, tuberose, chrysanthemum, marigold

Table 1. Costs and returns from flower retailing in Chikkaballapura

Particulars	Kinds of Flowers									
	Nerium	China aster	Rose	Tuberose	Kakada	Jasmine	Chrysanthemum	Marigold	Crossandra	Bachelor's Button
No. of respondents	1	3	35	7	40	32	14	14	26	2
Average annual quantity sourced (kg)	150	1000	403	514	692	773	1071	750	354	750
Cost of loose flowers (₹per year)	9450	16500	17121	44229	124538	139219	84643	24750	134389	49500
Tying and value addition (₹per year)	4500	20000	4029	7714	27675	38672	10714	7500	17683	22500
Travel cost (₹)	0	400	241	571	239	247	107	625	231	375
Total cost (6=2+3+4+5) (₹)	14100	37900	21794	53029	153143	178911	96536	33625	152656	73125
Gross returns (₹ per year)	34500	198000	71840	85680	381915	426938	176786	78000	237655	241500

and bachelor's button were reported to be retailed by less than 50 percent of the respondents. In terms of average quantity sourced per annum from lean and peak seasons, chrysanthemum topped the list with 1071 kg followed by China aster, jasmine, marigold and bachelor's button. The remaining flowers like *kakada*, tuberose, Nerium, crossandra amounted to less than 700 kg, meaning that on a daily basis, each vendor bought less than 2 kg loose flowers of this type. The price of loose flowers varies with season, so the weighted average prices as reported by respondents are used for computing the total purchase cost of individual flower type. The value additions in the form of tying these flowers including the cost of thread are elicited from respondents. The daily travel cost for commuting between home and wholesale markets are apportioned across flower types by dividing the per trip total expenditure by the number of flower types bought by the vendor. The total travel costs of all the retailers handling a particular type of flower are averaged to arrive at the travel cost of individual flower types. Only Nerium flower is sourced locally without incurring any transportation cost. The highest transportation cost is incurred in the case of marigold (Planning Commission of India 625 per annum) while the least was in the case of chrysanthemum, accounting for Planning Commission of India107.10. The total cost including sourcing loose flower, transportation and tying charges were the highest in jasmine (₹178138) followed by *kakada* (₹52451) and crossandra (₹152302) in that order. All the other flower types needed less thana lakh rupee in the form of working capital per annum towards sourcing flowers and preparing flower garlands for retailing. The gross returns realization was the highest from jasmine (₹426938) followed by *kakada* (₹381915), bachelor's button (₹241500) and crossandra (₹237655) in that order. The lowest gross returns realization is from Nerium flowers (₹34500 per annum) which is likely due to low volume of flowers transacted. The net income realization per day is the highest in the case of jasmine (₹710.85) followed by *kakada* (₹655.61), bachelor's button (₹483.2), and China aster (₹460.30). Only tuberose and Nerium yielded less than ₹100.00 earnings per day.

The costs and returns pattern for retailing flowers in Bengaluru city shows (Table 2) that *kakada*, crossandra, marigold, chrysanthemum, roses and jasmine flowers were handled by more than 50 percent of respondents on a daily basis. The quantity of flowers sourced annually revealed that marigold (361.53 kg) was in the lead followed by jasmine (340.90 kg), bachelor's button (330 kg) and tuberose (321.42 kg), while the least quantity handled per annum was that of Nerium (202.2 kg). The daily net income realized was the highest from jasmine (₹458.6) followed by *kakada* (₹447.3). The profits were the least in the case of chrysanthemum, marigold and roses amounting to less than ₹100.00 per day. Thus, it could be concluded that dealing in an assortment of

Table 2. Costs and returns from flower retailing in Bengaluru city

Particulars	Kinds of Flowers									
	Nerium	China aster	Rose	Tuberose	Kakada	Jasmine	Chrysanthemum	Marigold	Crossandra	Bachelor's Button
No. of respondents	23	4	36	7	50	33	38	39	44	5
Average quantity sourced (kg/year)	202	225	275	321	290	341	249	362	228	330
Annual cost of loose flowers (₹)	17387	9675	14575	34071	70928	78409	24620	23862	98215	21120
Tying and value addition (₹per year)	6066	4500	2750	6107	297	17046	2487	3615	11421	9900
Travel cost (₹)	1700	1200	1613	1071	1495	1756	144	1645	1448	1980
Total cost (₹)(2 to 5)	25152	25152	25152	25152	25152	25152	25152	25152	25152	25152
Gross returns (₹per year)	66717	58050	40744	85243	229284	257727	41033	47723	172677	106260

flowers would generate higher net returns.

Contribution of Income from Flower Vending to Family Consumption Expenditure

The contribution of flower vending to family consumption expenditure is computed for assessing the livelihood dependence of households on flower retailing. The consumption expenditure on six major categories, viz., cereals and oil, milk and meat, education and healthcare, house rent and clothing, fruits and vegetables, and sundry expenses are obtained through family budget survey. The contribution from flower retailing towards each major item is ascertained through the survey. It could be observed from Tables 3 and 4 that in Chikkaballapura, the average monthly household consumption expenditure was ₹7555, of which cerealsand oil, and house rent and clothing accounted for the major share constituting ₹2242.00 and₹2222.00, respectively. The expenditure on children education and healthcare accounted for ₹1372.00. All the other categories constituted less than ₹1000.00 each. The flower retailing contribution towards household consumption expenditure varied from 69.75 percent to 78.50 percent. Thus, it could be concluded that earnings from flower retailing constituted a major source of household expenditure.

The household consumption expenditure (Table 4) in Bengaluru city amounted to ₹11887.00 per month. The major items of expenditure were on house rent and clothing (₹5512.00), cereals and oil (₹2675.00) and children education (₹1496.00). The expenditure on all the remaining categories amounted for less than one thousand each per month. The lower expenditure on fruits and vegetables, and milk and meat is a cause for concern as these items form a major part of human diet and nutrition.

Quartile Distribution of Flower Retailers According to Per Capita Earnings

The income earnings are computed for quartile samples for gaining a clear understanding on whether the access to earnings from various sources is evenly distributed across the respondent households. The quartile distribution of respondents according to sources of income is computed and depicted in Table 5. It could be observed from the table that among the three major sources of household income, flower vending accounted for more than 75 percent of the household's earnings in all the four quartiles. A comparison of monthly household earnings reveals that, there is marginal difference between first (₹19758) and the second quartiles (₹19875). Similarly, the third and fourth quartiles were also with more or less similar earnings of₹30795.00and ₹31719, respectively. Therefore, it could be inferred that, there is a quantum jump in income from second to third quartile, unlike the comparison between the first two and the last

Table 3. Contribution from flower retailing to monthly household consumption expenditure in Chikkaballapura

(n=45)

Expenditure categories	Total expenditure (₹)	Share of flower retailing (₹)	Other sources (₹)	Percent share from flower retailing
Cereals and oil	2242	1627	616	73
Milk and meat	836	598	274	72
Education of children and hospital	1372	1048	323	76
House rent and cloth	2222	1570	652	71
Fruits and vegetables	476	373	102	79
Sundry expenses	408	284	123	70
Total	7555	5501	2090	

Table 4. Contribution from flower retailing to monthly household consumption expenditure in Bengaluru city

(n=55)

Expenditure categories	Total expenditure (₹)	Share of flower retailing (₹)	Other sources (₹)	Percent share from flower retailing
Cereals and oil	2675	1444	1232	54
Milk and meat	865	527	337	61
Education of children and Hospital	1496	739	757	49
House rent and cloth	5512	2634	2879	48
Fruits and vegetables	673	415	258	62
Sundry expenses	665	204	462	31
Total	11887	5962	5925	

two quartiles with more or less similar earnings. The share of income from flowers accounted for 76 percent (₹19497), while that of agriculture and other sources accounted for 5 and 19 percent, respectively. Further, in Chikkaballapura the male members of the households also participated in different activities associated with flower retailing.

The quartile distribution of respondents from Bengaluru city according to monthly per capita income earnings revealed that income from flowers accounted for 59-63 percent of the total household earnings among the different quartiles. The households in the first quartile on an average earned a sum of ₹21763 per household, while the second and third had earned respectively ₹29598, and ₹38321 per month. The households in the fourth quartile earned an average of ₹52256 per month from all the sources put together. The income earnings among the four quartiles were highly skewed among the sample respondents in Bengaluru as compared to Chikkaballapura (Table 6).

Quartile Distribution of Households According Purchasing Power Parity Per Capita

The Purchasing Power Parity per capita (Rangarajan's Committee) method was used to compute quartile distribution of households according to monthly per capita expenditure. The household consumption expenditure was divided by family size, standardized through a weighting procedure of giving smaller weightage (0.7) for children below 14 years and older people (above 65 years age). The results are presented in Table 7. It could be observed that in Chikkaballapura, the first quartile of respondents had an average monthly per capita expenditure of ₹1307 which is below the per capita poverty line of ₹1407 per person. These findings are in line with Rangarajan's committee findings of 29.5 percent of households living below poverty line (Planning Commission of India, 2014). The household expenditure serves as a proxy for income earnings logically as they can't spend without earning in the first place. The expenditure increments between the concurrent quartiles widened from first to the fourth quartile. Similarly, for Bengaluru city, the average per capita expenditure for the first quartile was ₹2574 per month, which increased to ₹4392 for the fourth quartile. The expenditure gap between third and fourth quartiles is narrower as compared between the first and second quartile groups. Thus, the economic status of households reveals that a majority of the sample households are above the poverty line, mainly because of the complementary earnings from flower retailing by women.

Table 5. Quartile distribution of respondents according to monthly percapita income earnings in Chikkaballapura

(Amount in ₹; n=45)

Quartile	Flower	Agriculture	Other business	Total
First	14848	2182	2727	19758
Second	15511	545	3818	19875
Third	24659	1227	4909	30795
Fourth	22969	1000	7750	31719
Average/ Househol	19497	1239	4801	25537

Table 6. Quartile distribution of respondents according to monthly per capita income earnings in Bengaluru city

(Amount in ₹; n=55)

Quartile	Flower	Other business	Total
First	13686	8077	21763
Second	17813	11786	29598
Third	23750	14571	38321
Fourth	31042	21214	52256
Average /Household	21573	13912	35485

Table 7. Quartiles of flower vending households according to Purchasing Power Parityper capita

(Value ₹)

Quartile	Chikkaballapura (n_1=45)	Bengaluru city (n_2=55)
First	1307	2574
second	1795	3437
Third	2534	3723
Fourth	3631	4392

CONCLUSIONS

The sources of household income revealed that income from flower retailing contributed more than 60 percent of the household income indicating the livelihood dependence of households on flower vending. The Purchasing Power Parity per capita (Rangarajan method) was used to compute quartile distribution of households according to monthly per capita expenditure. The per capita expenditure of all the quartile of Bengaluru city and the last three quartiles of Chikkaballapura sample respondents were above the poverty line. This shows that flower vending has a significant role in the food and livelihood security of a large number of women who have no formal education and lack employment opportunities in other sectors.

REFERENCES

Oberhauser, Ann M., & Kobena, T. Hanson. (2008). Negotiating livelihoods and scale in the context of neoliberal globalization: perspectives from Accra, Ghana. *African Geographical Review*, 26, 11-36.

Planning Commission of India. (2014). *Report of the expert group to review the methodology for measurement of poverty*. Chaired by C. Rangarajan, Planning Commission of India, Government of India.

Economics of Crop Production, Technology, and Sustainability

Chief Rapporteur: Dr. Jasdev Singh
Rapporteurs: Dr. Jatinder Mohan Singh, Dr. Sukhdev Singh, Dr. Sanjay Kumar, Dr. Raj Kumar, Dr. Jatinder Sachdeva, Dr. Baljinder Kaur Sidana, Dr. Sangeet, Dr. Shruti Bhogal
Department of Economics and Sociology, Punjab Agricultural University, Ludhiana

Under the theme of cost of cultivation, technology,and sustainability, out of total thirty-nine papers received, thirty-three papers were selected for the presentation in the conference. In their paper on Nigerian agriculture, Sadiq and Singh found that overtime the agricultural economy of Nigeria has been drifted towards specialization. They suggested that to derive the maximum benefit inherent in comparative advantage, need of hour is to focus on further specialization of crop sub-sector through addressing problems in agricultural credit as well as the cross-border smuggling of agricultural commodities. Swamy *et al.* outlined the benefits of paddy-maize cropping pattern in terms of better natural resource utilization, and also as an alternative for diversification from the popular paddy-paddy and paddy-wheat cropping system in North Eastern Karnataka. The paper highlights the problems attached to this emerging and viable cropping system.The paper 'Impact of neem-coated urea on production, productivity and soil health in Punjab' brings out that the application of NCU facilitates increase in productivity and returns, improves the retention of nitrate in the soil, and reduces cost of pest and disease control. Since the cooperative societies were the main source of supply of NCU, the paper suggests timely, adequate and quality supply of NCU to these societies. The paper 'Án Economic Analysis of Bio-pesticides use in Paddy Farms of Kerala' highlights the economic and environmental benefits following the use of bio-pesticides. The paper points out that these pesticides not only improve the yield, enable reduction in of costs of cultivation and use of pesticides but also may have a positive impact of human health.In the study "A shift in traditional production system: a case study of natural rubber cultivation in Tripura" the authors found that with the introduction of natural rubber (NR) cultivation, the rural economy of the state transformed from labour based subsistence economy to commercial plantation-based economy. The authors emphasized the need to replicate NR cultivation model of Tripura in other regions of the country having similar socio-economic and agro-climatic conditions. Maurya *et al.* in their study on "Sustainable livelihood security in eastern Uttar Pradesh" constructed the Ecological Security Index (ESI), Economic Efficiency Index (EEI) and Social Equity Index (SEI) on district level data which revealed that the agricultural systems of all the districts display wide variation in their ecological and social equity aspects relative to their economic aspects.

Singh *et al* in their study explored the farmer's attitude towards paddy straw burning in Punjab. According to results, under the present agricultural situation,there is no viable alternative to this problem and the proposed paddy straw management alternatives to burning are cost-intensive, laborious and results into delay in wheat sowing.Singh and Kaur studied the problems of summer moong cultivation in Punjab and found that uncertainty in weather, unavailability of labour and knowledge about machinery for value addition and packaging, lack of market information and lack of advances against the produce were the major constraints in popularising this important pulse crop in the state. Similar problems were also reported by Prakash *et al.* in the production and marketing of strawberry cultivation in Haryana. Parth*et al.* conducted the conjoint analysis and found that among the technological attributes of Pigeonpea, farmers in Saurashtra Region (Gujarat) preferred crop duration as the most important, followed by plant height, viral disease and wilt resistance, output price and yield.

According to Dhawan *et al.* during last three decadesprofits increased significantlyfrom paddy, wheat and cotton cultivation in Punjab though it was relatively higher for wheat and cotton during last ten years. It emphasized the need for development of new high yielding varieties and higher adoption level of resource-conserving technologies by farmers to achieve sustainability in agriculture. Another study from Gujarat on acreage response to weather, yield and price indicated a significant positive relationship of acreage under groundnut and sesamum with rainfall andemphasized upon the need to strengthening of weather advisory services in the state. The paper "Potential of traditional irrigation system for sustainable development of hill agriculture' showed that with available natural irrigation system, more efficient returns can be obtained by patronizingoptimized cropping systems with improved technology. Amrutrao *et al.* found that use of drip irrigation system (DIS) in cotton crop in Maharashtra was highly profitable and resulted in higher yield and net returns (1.75 times) in comparison to that realized from the conventional system of irrigation. In two studies from Jharkhand and Karnataka, adoption of system of rice intensification (SRI) was observed to be economically sustainable with relatively higher yield levels, higher income and employment in comparison to the traditional methods of rice cultivation. Study by Kumar *et al* on three

resource conservation technologies being adopted in wheat cultivation in Haryana viz. zero tillage and laser land leveler or their combination recommends mass adoption of RCT'S to reap the potential benefits paving way for sustainable production. Through developing the optimum farm plans, Thorat and Sirohi suggested that with the reallocation of resources among various crops and dairy enterprises the farm incomes in the Marathwada region of Maharashtra can be increased significantly. However, positive impact of resource reallocation can only be realized by proper institutional revamp. Papers by Dhandhalya *et al* and Sanap *et al* measured the productivity growth of rice and sugarcane in Gujarat and Maharashtra states respectively. Both states has shown a shown a good performance on account of TFP growth for their respective study crops. Rainfall along with institutional variables like investment in agricultural research, development of roads and irrigation infrastructure had shown a positive and significant impact on the TFP growth. Kaur &Katariaanalyzed the state level data on agricultural performance which indicated strong evidence of β-convergence implying that the states with poor performance in past are catching up with agriculturally advanced statespost-2000.

Bondar *et al.* inferred that in green gram production in Maharashtra, sub-optimal use of manures, nitrogen, potash and human labourpoints towards chance of raising theproduction of this crop by the increasing the use of these inputs. Singh and Grover brought out that in case of basmati cultivation, there is saving in human and machine labour as compared to non-basmati cultivation and its adoption on more area can also address the sustainability issue in Punjab. Ashu *et al.* emphasized on potato seed production in Haryana and found it profitable with the adoption of contract farming due to remunerative prices and higher yield. Another study by Kamal *et al.* on pulses production in Haryana revealed that large farmers got higher net returns in pulses cultivation due to their higher retention capacity as compared to small and medium farmers who encountered distress sale of their produce.

Kamble *et al* in two separate papersevaluated the adoption, impact,andcost-effectiveness of technology in production of cotton and chickpea along with the constraints encountered by the farmers in the Maharashtra state. In another study from the same state, Nimbalkar *et al* examined the actual technology adoption level in wheat crop and revealed that out of 12 technologies, three technologies viz. seed treatment, application N, P and K,and irrigation have maximum contribution in wheat production. Waiwal*et al.*andBhagwat *et al.*in their respective studies,highlighted that in post-liberalization period due to expansion of modern technology the instability in agriculture production in the state of Maharashtra had declined significantly.

A research paper entitled "Water and energy use efficiency of maize vis-à-vis paddy crop in Punjab agriculture: a move towards crop diversification" reveal that while per hectare returns were higher in case of paddy; per hectare, water productivity was much higher and energy-use was quite lowerin maize production in comparison that of paddy.Impact ofclimate change was assessed by Choudhary & Badal (2018) through constructing vulnerability indices for 18 districts of Eastern UP and ranking those districts on both criteria's i.e. climatic vulnerability and agricultural vulnerability. The study also identified the most vulnerable and the least vulnerable districts on this account. Mahal and Kaur analyzed the trends in weather variables and found that the changes in climatic variables like maximum temperature, minimum temperature, humidity, sunshine hours, etc.during different growing stages of crop have important implications on wheat productivityin Ludhiana district of Punjab.

Agricultural Marketing: Opportunities and Challenges

Chief Rapporteur: Dr Manjeet Kaur
Rapporteurs: Dr. Simran Kang Sidhu, Dr. Shalini Sharma, Dr. Milkho Kaur
Department of Economics and Sociology, Punjab Agricultural University, Ludhiana

The contributed papers covered various aspects of agricultural marketing such as product marketing channels, margins, marketing constraints, input purchase behaviour, market integration, land marketing, market infrastructural status, ground water markets, import and export pattern of agricultural products, post harvest losses and contract farming etc.

A paper on marketing pattern of rapeseed and mustard in Bathinda district of Punjab based on data collected from 80 farmers found that the market margin of processor was the highest and suggested farmers to add value to their produce at their own on cooperative basis. Another paper studied marketing of mustard in Fatehgarh district of Haryana by selecting a sample of 35 stakeholders functioning in the marketing of mustard. It observed that the marketing channel of Producer-Wholesaler- Retailer-Consumer was highly dominating among the other identified channels. Highest quantity of the produce was marketed through this channel but the marketing efficiency was low due to number of intermediaries and high cost and margin.

Another research paper on the marketing of finger millets was based on South Gujarat region by selecting two markets from two districts near the production area of finger millets. The results showed that producers received high price in the markets by selling the produce to retailers rather than directly marketing to consumers or selling to local markets. Lack of marketing facility followed by inadequate market information fluctuation in market price and lack of storage facility were the constraints faced by producers of finger millets.

A study on marketed surplus of milk for sustainable development in Sirsa district of Haryana highlighted the role of milk cooperative societies in giving remunerative prices to the dairy farmers. It found that herd size, price of milk and nearness of cooperative society had positive and significant relationship with marketed surplus of milk.

The marketing problems were highlighted by beneficiaries of Self Help Groups in marketing of the products produced by them in another paper. Heavy competition, difficulties in transportation, shortage of good quality raw material, improper use of funds were the constraints faced by beneficiaries of Self Help Groups.

A paper studied the role of traditional flower retailing by women on household livelihood security in two districts selected for dry zone of Karnataka. It found that the income from flower retailing contributed more than 60 per cent towards the family income. None of the households of these women were below the poverty line.

Another paper studied the pattern of agricultural land marketing in south-western region in Punjab based on the data collected from 120 farmers who entered in the land sale market during 2011-2015. The study showed that the small and semi-medium farmers were the major players of land sale market. In case of small farmers the reason of selling land was repayment of old debt, expenditure on immigration of family members, construction of house and social ceremonies.

A paper on India's foreign trade of agricultural products studied the trends, composition and direction of trade of agricultural products in liberalised economy from 1990-91 to 2015-16. The study highlighted that India shared better trade relations with Vietnam, UAE, Saudi Arabia and USA. The paper called for exploring potential markets for agricultural products in Europe and Africa with prime focus on integration of technology, innovation and better marketing infrastructure.

Another paper attempted to model and forecast the sugar prices volatility in Indiausing time series data on the monthly wholesale price index for 1995-2015 and found relationship between spot and future prices of sugar. It founds autoregressive conditional heteroscedasticity models appropriate in modelling and forecasting sugar price volatility.

Commodity prices provided signal to producers, consumers and market players for decision making.Under poor market integration, price signals were disturbed leading to inefficient use of resources. Three papers dealt with the price volatility and integration of market issues. Market integration of major maize markets was analysed using weekly time series data on maize prices for the period 2012-2014 for national and international markets. Suitable statistical techniques were applied and findings highlighted that regional markets for maize had strong price linkages and were spatially integrated. It also revealed that any disturbance in price will be corrected in about 6 hours to 16 hours in various selected markets and suggested Government to strengthen the market intelligence and communication within markets to achieve the goal of market integration.

Another paper investigated the extent of prices integration and transmission in Indian wheat market based on monthly wholesale prices data from July 2002 to June 2017. It revealed the wheat markets were more competitive in a majority of regions. The poor performance of wheat markets warrants for policy interventions and investment plans for sustainable development as commodity is linked with livelihood and nutritional security of millions.

One of the paper analysed the infrastructure status

and problems faced by market functionaries in regulated markets during 2015-16. The study was based on primary data collected from six markets selected from the existing three zones of Haryana state having highest arrival of wheat and paddy during last five years.The study found the inadequate post-harvest facilities in most of the markets followed by poor security. The requirements such as covered sheds, open platforms, godown becomes inadequate during peak activities which led to wastage of producers due to bad weather conditions. Market committees were constantly spending money to remove these deficiencies. Online marketing of producer had also been started in few selected markets but internet facility was found to be inadequate and shortage of staff in mandies was also reported by the study.

Another paper examined the post harvest losses at different stages in fruits in Madhya Pradesh. The study was based on secondary as well as primary data collected from Jabalpur regulated market and 55 wholesalers. The fruits considered for study were banana, mango and papaya. The highest losses were observed during transportation of mangoes and maximum losses in banana were observed during storage.

Impact of globalisation on transforming Indian economy had been studied in a paper on trends in foreign trade, foreign investments and foreign exchange reserves during the period 1991-92 to 2013-14. The paper revealed that globalisation had positive and negative impact on Indian economy; positive in terms of accelerating the growth of GDP and increase in the share of service sector to GDP. On negative side, the globalisation had adverse effect on employmentand referred the period under study as jobless growth period. It showed that globalisation had also generated high inequalities among Indian people.

Purchasing behaviour of farmers towards non-durable inputs namely seeds, fertilizers and herbicides was analysed in one of the papers. Itwas observed that the household head was the main decision maker in purchase of inputs, retailers were the major source of information and farmers preferred branded seeds & fertilizers. Retail stores were the preferred source of purchase as they provided credit facility to farmers living in nearby villages.

Paper on contract farming reviewed the contract farming regulation with special references to state of Gujarat and Maharashtra. Some issues pertaining to formal and informal contract, contract regulation and dispute settlement as prescribed by the model APMR Act (2003) and the Rules (2007) have been discussed. As per the APMR Act and set of rules include provisions for the registration of contract farming (CF) sponsors, the recording of CF agreements with some authority prescribed under the act and a vital dispute settlement mechanism. The studybought out that the multinational corporation involved in contract farming for large scale production of white onions and chips grade potatoes in Maharashtra and Gujarat was not registered with the prescribed authorities. Farmers were unaware of existence of dispute settling authorities and felt helpless whenever dispute arises.

All the research studies highlighted various facets of agricultural marketing at national and international level. Issues related to agricultural marketing were well addressed and recommendations were suggested accordingly.

Farm Income, Employment, Credit and Investment

Chief Rapporteur: Dr. Mini Goyal
Rapporteurs: Dr. Poonam Kataria, Dr. Parminder Kaur and Dr. Arjinder Kaur
Department of Economics and Sociology, Punjab Agricultural University, Ludhiana

Agricultural credit plays an important role in the agricultural development. In fact, facilitation of access to credit can raise amount of productive investment. The need for agricultural credit, however, becomes all the more important when it moves from traditional agriculture to modern agriculture. Under the sub-theme of agricultural credit, a total of 14 research articles were received for publication in 5th National Seminar out of which 10 were accepted for publication. Jamaludheen & Kiresur in their study assessed the financial support extended by various credit institutions in the central dry zone of Karnataka in terms of credit delivery, transaction costs and access to credit. It was brought out that necessary steps needed to be taken by the credit institutions in the form of special lending programmes for extending financial support to resource poor dryland farmers. Another study by Toor *et al* on asset inequalities among farm households in the rural Punjab attempted to analyze the prevailing disparity level in asset ownership. It was brought out that decreasing the inequality levels tend to promote higher and more stable development process which in turn, has significant impact on employment generation and reduction of poverty. The study on evaluation of Kisan Credit Card scheme in Himachal Pradesh has shown a significant increase in its adoption with increase in farm size and area under vegetable crops, while higher education and increase in family income reduced the probability of adoption. The probability of regular repayment was found to be increasing with the increase in area under the vegetables and total family income. Sampled farmers favored the revision in credit limit to meet the rising input prices.A study undertaken by Garg has highlighted the trend and pattern of capital formation in Punjab agriculture. It was found that agriculture and allied sectors were contributing less to gross capital formation as compared to non-agricultural sectors. Public sector capital formation in agriculture and allied sectors has declined while the share of private sector has gone up.Singh *et al*. have analyzed the poverty among scheduled caste households in rural Punjab. On income per household basis 36 per cent rural households were living below poverty line in the sample, with highest incidence in Shri Mukatsar Sahib (50 per cent). The major factor influencing the income per capital was non-agricultural income, while consumption expenditure was being affected by expenditure on education.

Role of Subsidiary Occupations in Sustaining Agriculture

Chief Rapporteur: Dr. Inderpreet Kaur
Rapporteurs: Dr. VarinderPal Singh and Dr. Nitin S. Wakchaure, GADVASU, Ludhiana

Livestock sector is an important component of agricultural economy of Punjab state as contribution of livestock in GDP is significant and improving overtime. Further, livestock provides cushion in distress situation of farmers. Under the sub-theme of livestock economics, a total of 15 research articles were received for publication in 5th National Seminar out of which, 07 were accepted for publication. The accepted papers covered diverse areas under the domain of livestock economics including dairy co-operative movement, structural changes in dairy sector, goat rearing, comparative economics of cow and buffalo, knowledge level of trained vs untrained dairy farmers and status of green fodder availability.From the papers received, few conclusions can be drawn which can be very useful for the livestock sector of India. Kumari et al from their study on dairy co-operative movement in India reported that dairy co-operatives play an important role in improving the dairy farming in India and making the enterprise sustainable, not only economically but also socially. Another study by Makarabbi et al on structural changes in dairy sector of Karnataka state brought out that the input cost of milk production is increasing due to more number of indigenous cow and buffaloes with less milk production in Karnataka state. The study stressed the need for structural changes in dairy sector in favour of high yielding species and animals. Hileet al studied the comparative economics of crossbred cow vs pandharpuri buffalo milk production in western Maharashtra and observed that crossbred cows were more economical and can increase the income of dairy entrepreneurs and provide gainful year-round employment to the family. Horo et al. in their study on decomposing the effect of technological change in milk production found out the total change in yield was 80.59 percent, out of which 73.31 percent was contributed by technology and 7.13 percent by change in input use level in Jharkhand state of India. The results indicated that crossbred technology has high yield potential but considerable efforts are required to improve the efficient use of inputs. Green fodder is important component of dairy farming. Singh et al studied the availability of green fodder in various zones of Punjab state. The green fodder deficiency in Punjab state was estimated to be 22.99 million tones which was 28.57 percent of the total green fodder requirement. For studying the knowledge level of dairy farmers of Punjab state, Singh et al conducted a survey and concluded that majority of trained and untrained dairy farmers (66.6 and 58.3 per cent) had medium knowledge level regarding improved dairy management practices. All the above-mentioned studies made important observations regarding the dairy farming in India.

Further, among the livestock enterprises, goat rearing is also contributing in enhancing farmers' income. Pawar et al studied economics of goat rearing in Ahmedgarh district and highlighted that goat rearing can be additional source of income and employment for landless agricultural labourers, small and marginal farmers.

From the scrutiny of various research articles pertaining to livestock sector, it may be concluded that dairy farming has gone through the structure and technological change and crossbreed cows played an important role. Input cost is higher for the indigenous cows due to less milk yield. There is need of improving the availability of green fodder for the development of dairy sector. Dairy Co-Operatives should be strengthened and its network should be expanded so that maximum number of farmers can be benefitted Other livestock enterprises like goat farming which provide good income especially to weaker sections of the society should be promoted by providing various types of incentives.

Agriculture: Socio-economic Issues and Changes

Chief Rapporteur: Dr. Prabhjot Kaur
Rapporteurs: Dr. Dharminder Singh, Dr Pankaj Kumar and Dr. Manmeet Kaur
Department of Extension Education, Punjab Agricultural University, Ludhiana-141004

Research and development for sustaining agriculture is need of the hour. It's the continuous research which can address various emerging problems in agriculture and farmers. Similarly gender equity is an issue of all of the times. Under the sub themes of Role of research and development in sustaining agriculture and mitigating the various emerging rural socio-economic problems, and Gender equality and human resource development for sustainable agriculture a total of 20 research articles were received for publication in 5th National Seminar out of which, 17 were accepted for publication and one is required to be resubmitted. These accepted papers covered various aspects of the agriculture research and development and gender issues.

Ahmad *et al* presented the data on comparative performance of Mahatma Gandhi National Rural Employment Guarantee Scheme of rural women labour participants in Punjab and Karnatka and concluded that MGNREGS is performing better in Karnatka as compared to Punjab state, however the problems like illiteracy, lack of technical skills, corruption, lack of child care facility etc. are hampering its performance. Shah and Sharma analyzed opinion of teachers towards quality assurance in higher agricultural education and found that majority of the respondents were satisfied with the different quality assurance measures. Rathod & Devi emphasised that microfinance is a better option to empower rural or tribal women by income and employment generation through SHGs formation. Jagdambe *et al.* analyzed the effect of non-farm employment on farm commercialization in rural India and found that participation of household in non-farm had negative relationship with agricultural commercialization. Researchers indicated that the households with alternative opportunities would remain subsistence farmers or even move towards subsistence farming. Pokharkar & Gulave recommended that Maharashtra Government should invest more in research and extension activities of Pomegranate as this crop has high internal rate of return and has potential to improve farm economy of the state.

Brar *et al.* studied problems of farmers engaged in direct seeding of rice and found weed infestation as the biggest problem in this. Sharma and Kaur revealed that majority of the agripreneurs had medium to high risk taking ability as well as innovativeness. Kaur *et al.* found that fruit and vegetable preservation as the main enterprise adopted by members of PAU Kisan Club (ladies wing) and further majority of the members were doing business individually. Ray & Rampal recommended that gap in level of awareness about the GM technology needs to be resolved by providing genetic literacy among farmers. Kaur*et al.*reported that there was a high level of degradation of natural resources and in the opinion of respondents depletion of fuel, fodder and water has impacted their lives to a large extent. Sharma et al analyzed the secondary data and found that there was decline in percentages of stunted and underweight children but there was increase in percentage of those suffering from wasting during the reference period. Kaur *et al*. observed that if the products like water proof masks, mixing mat, apron, gloves and hood developed at home can help to save money and in this way further help in capacity building of the rural women. Kaur et al conducted demonstrations for the popularization of Direct Seeded Rice (DSR) and observed that farmers were using excessive doses of fertilizers and pesticides in transplanted rice (local check). Further the total cost of cultivation of the DSR was found to be₹25370 per ha, while it was ₹32474 per ha in the case of traditional method. Singh and Singh found that majority of the respondents used to seek the information from pesticide dealers and personnel of agricultural cooperative societies for Bt cotton cultivation; hence their regular trainings were emphasized. Sidhu and Garg reported that the mobiles and mobile-enabled applications are one such service that will go a long way in making the agro advisory to farmers more efficient and effective.

From the perusal of various research articles come under sub themes of Research and development for sustaining agriculture and gender issues it may be concluded that lot of research is going on for making agriculture more sustainable as well as for the empowerment of women and human resource development in agriculture.

Indian Journal of Economics and Development

Guidelines for Submission of Articles

1. The research articles, review articles, book reviews, general articles, research notes, and short communications in basic and applied research in Economics, Agricultural Economics, Management and Development Economics are published in ***Indian Journal of Economics and Development.***
2. The journal is managed by the eminent economists under the domain of Society *of Economics and Development* and published quarterly.
3. The authors submitting papers to *Indian Journal of Economics and Development* should be members of this Society.
4. The manuscript may be submitted online through *www.indianjournals.com* or via email editorijed@yahoo.com. All articles must include an abstract of not more than 100 words.
5. The length of papers should not be more than 20 typed pages of B5 size in Times New Roman font size 11 including tables, diagrams and appendices.
6. Name(s) and affiliation(s) of the author(s) with email addresses should be provided on a separate page along with the title of the article.
7. Only essential mathematical notations may be used. All statistical formulae should be neatly typed in MS Equation. Footnotes should be numbered consecutively in plain arabic superscripts.
8. **References:** Only cited works should be included in the reference list. The references should be alphabetical and as per APA style (http://soed.in/wp-content/uploads/2017/02/APA-Guide.pdf).
9. **Units:** Use SI units; a few examples are given below: Hectare (ha), Milligram (mg), Rupees (₹), Million hectares (Mha), Litre (l), Tonne (t), Millilitre (ml), Million tonnes (Mt), Gram (g), Meter (m), Kilogram (kg) and Centimeter (cm). Please note that no full stop is used after the abbreviation of units.
10. All articles will be referred in anonymity. The authors should comply with the comments of the referee within 20 days, beyond which the papers will be removed from the files of the Society.
11. **Transfer of Copyright Agreement:** Submission of a manuscript implies that the work described has not been published before (except in the form of an abstract, or thesis); that it is not under consideration for publication elsewhere; that if and when the manuscript is accepted for publication, the authors agree to automatic transfer of the copyright to the publisher. All the manuscripts must be accompanied by a signed Copyright Form at the time submission.
12. **General:** The Editorial Board reserves the right to remove the material considered irrelevant. It assumes no responsibility for the views and statements expressed by the authors in their articles.

Date of Publication: April 01, 2018
NAAS Score: 4.82
Indexed in Clarivate Analytics (ESCI)
UGC Approved

Indian Journal of Economics and Development

Secretarial Office

Society of Economics and Development

Department of Economics and Sociology
Punjab Agricultural University
Ludhiana - 141004 (Punjab) INDIA
Email : chiefeditorijed@gmail.com

ISSN 2277-5412