ISSN 2277-5412

INDIAN JOURNAL OF ECONOMICS AND DEVELOPMENT

Volume 8 April-June 2012 No. 2

SOCIETY OF ECONOMICS AND DEVELOPMENT

Indian Journal of Economics and Development

Editorial Board

ISSN 2277-5412

Indian Journal of Economics and Development

SOCIETY OF ECONOMICS AND DEVELOPMENT

Indian Journal of Economics and Development
Volume 8 No. 2: 2012

Printed and Published by Dr. Narinder Pal Singh on the behalf of the Society of Economics and Development

Email: editorijed@yahoo.com

Printed at Ravindra Printing Press, Industrial Area B, Ludhiana-141003
Phone: 0161-2535577 Email: ravindra@yahoo.com

Indian Journal of Economics and Development

(Journal of Society of Economics and Development)

Volume 8 **April-June 2012** **No. 2**

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Indian J. Econ. Dev.
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MATCHING MARKET INFRASTRUCTURE REQUIREMENTS FOR AGRICULTURAL REVOLUTION IN PUNJAB

Joginder Singh*

ABSTRACT

The Indian Punjab agriculture has witnessed decelerating growth followed by stagnating productivities of wheat and rice, the major crops at near the potential levels. A strong need is felt to diversify it in favour of high value farm enterprises such as fruits, vegetables, cotton, basmati, spices, flower cultivation, livestock enterprise, etc. The basic hiccup for this diversion is lack of market infrastructure. The recent trend of organized retail stores appears to have helped in this direction. The value addition in different forms supported with market intelligence system for catering to domestic and export market can help to boost production of such potential farm products.

INTRODUCTION

Agricultural marketing and external trade in agricultural commodities are assuming increasing importance in the wake of ushering in second *Green Revolution*, improving the living standards of farm families, making India hunger free and turning poverty into history in the shortest possible time. The challenges facing the marketing system are quite different than what these used to be about two decades before (Anonymous, 2007). The *Green Revolution* which ushered in mid-sixties in Punjab appears to have been faded away till early nineties, leaving agriculture sector to struggle for its mere sustainability. This is apparent from the fast sliding compound growth rate in this sector from 5.37 percent in 1980-85 to 1.90 percent in 1997-2002, 2.25 percent in 2002-07 and is expected to be 2.40 percent during 2007-12 periods (Table 1).

Apparently, there is little scope for improvement in productivity of food-grain crops due to technology fatigue. The government and the policy planners kept

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high hopes on the research systems without rectifying the policies, particularly in terms of poor funding of the research and development, lack of initiative for value addition, non-economic use of huge mass of crop residue, encouraging overuse of most precious resources such as electricity, water and paralyzed export infrastructure.

Table 1: Annual compound growth rates of farm sector in Punjab

Period	Compound Growth Rates (%)
1980-81 to 1985-86	5.37
1985-86 to 1990-91	5.24
1992-93 to 1997-98	3.08
1997-98 to 2002-03	1.90
2002-03 to 2007-08	2.25
2007-08 to 2011-12	2.40

The nation cannot afford decline in foodgrain production in this small but high potential food security belt which is contributing about 12 percent to the national output. This is perhaps the reason that foodgrain price policy has less of economic rationale and more of social and political motives. An individual farmer agrees to the sustainability issues but immediate family livelihood is his top priority. Most of the potential alternative enterprises such as fruits, vegetables, milk, meat, etc. are highly perishable and require special marketing and processing treatments to find the domestic and export markets. In this paper an attempt is made to highlight the market requirements for boosting the sector's performance. Specific objectives of the study were:

i) to bring out the possibilities of vertical integration in terms of value addition in suggested alternative enterprises and
ii) to strive for scope of diversification within state agriculture through economically potential enterprises.

1. Organized Retail Management

The fact remains that an average farmer got expertise on production system, which he has nicely demonstrated on the ground. Now with the opening up of the economy, we need to view the things in diametrically opposite perspective. The production system has to be volatile to cater to the consumers' requirements. To capture the need of well-to-do sections of the society in terms of consumer's taste, product quality, safety, nutrition aspects, etc. the essential services are required to

be provided, necessitating the opening of retail chain stores in the state. Therefore, to demonstrate the technical and pricing efficiency, organized retailing through horizontal and vertical market linkages, harnessing the scale economies can be a feasible solution. Moreover, growing consumerism due to increase in disposable income, level of education, urbanization and attitude of younger generation, consumption oriented rather than production oriented market system is becoming better workable with the passage of time.

- Incurring such heavy investments is not within the reach of an average farmer who is handicapped by constrains of adequate resources.
- Farmers' cooperatives have not been successful due to over-interference of political system and thus lack initiatives to take up such activities.
- Autonomous investment is also a remote possibility as the state government has already washed off her hands with the excuse that it is starved of financial resources, obviously due to various populous measures adopted on different fronts. Initiation of contract farming was an interesting positive step taken by the state government a few years back. This experiment failed too due to a number of obvious reasons, especially over-interference of the state government.
- Thus, the only ray of hope is investments by big business houses.

Let the potential farmers' cooperatives and individual farmers also coordinate and compete within the system. Going a step further, market view should not be limited only to the domestic consumers but also to the potential global markets.

2. Value Addition of Agro-product-AWeak Link

Farm sector of high potential areas is facing serious environmental problems of falling water resources, declining soil health, pesticide residues, air pollution, etc. Monoculture throughout the state is the sole cause of rural unemployment and associated social problems. About 50 million tonnes of crop residues are burnt every year in Punjab. This calls for immediate attention of its use for livestock, degeneration as humus for soil, making industrial use such as manufacture of cardboard, paper, packing material, energy generation, etc.

There exists a vast production potential of fruits and vegetables, milk, spices, mushrooms, honey, meat, eggs, etc. which can replace rice and wheat crops but their contribution to the overall production is not responding due to lack of processing and

market improvements. The production of fruits, vegetables and various other farm products can be accelerated in the state but lack of processing facilities due to their seasonal production, high carry over cost and lack of processing attributes. Milk processing units are mushrooming in the state without causing much value addition. Nestle unit has set one good example by helping in setting up of commercial dairy units, providing extension services, spot guidance, systematic marketing, etc. and thus captured more volume and better quality of raw material. Lack of stable sugar and sugarcane price policy, sugar mills working for 3-4 months a year have left it globally noncompetitive. Even the cotton crop in the state has recovered recently after facing a long spell of disasters but is still at the crossroads as it requires a long chain of processing system right from ginning up to garment making. All these examples highlight the role of processing industry in not just for processing of products but also contributing to the R&D for boosting production. Still on papers, diversification of agriculture is our motto. Cotton, basmati, pulses responded to market signals but need value addition for their sustainability.

3. Market Outlook Services

Market information and outlook is another important dark area which if cared for prudently can help facilitating the process further. Market innovations are coming up at a fast rate and sale is which was affected on physically displaying of produce, is now being sold by sample, by quality description, by grade standards or even by display on internet. Even the use of *eChoupal* is limited to one or two states and few commodities only. Therefore, regularly monitoring the domestic and global markets by taking stock of demand, production, existing stocks, prices, technical barriers of trade (TBT) and sanitary and phyto-sanitary standards (SPS) requirements and other market forces including tariffication of importing and exporting nations is needed for guidance to the farmers and market agencies to facilitate their safe entry. Since, the small farmers do not have the capacity to develop such market infrastructure; it is for the state through the Farmers' Commission to work in this direction for some worthwhile performance.

The existing extension infrastructure should be reoriented to cater to the market information requirements of state agriculture.

4. Scope of Diversification

As presented in Table 1 under the guidance of economic forces, area under paddy and wheat has increased remarkably replacing mainly pulses and oilseeds. This led to various environmental concerns, particularly depleting water resources,

whcic will have to be addressed through shifting area from rice to alternative eco-friendly crops. There exists a vast production potential of various alternative crop and livestock enterprises which can replace rice and wheat crops but their contribution to the overall production is not responding due to lack of processing and other value addition processes, domestic market and export infrastructure. For making an attempt to diversification, clear cut agro-climatic regions should be used as guiding indicators. Some of these are highlighted under:

a. The state has south-western districts covering about 750 thousand hectares as a clear cut demarcated cotton belt having brackish underground water. Following a long spell of failure of cotton, paddy crop infiltrated in this area and the farmers had to explore deep groundwater through investing in submersible tube wells. Now, the cotton crop, after facing a long spell of disasters, is on the recovery path, particularly with the introduction of Bt cotton varieties. Apart from offering diversification possibility of agriculture from rice to cotton on another about 200 thousand hectares in the state, it has very high potential of employment and value addition in secondary and tertiary sectors.
b. The trend of shift in non-basmati to basmati rice has also set in the state which too requires policy thrust at this juncture. Its straw is normally used as livestock feed, requires less water, has high exportable potential and the crop offers opportunity for an additional short duration crop such as moong, fodders, green manuring etc and thus improving farm income. The magic performance of Pusa 1121 variety has shown that still much more unexplored genetic potential lies in this crop. For suitable research efforts in the area, different stakeholders such as processing industry, other concerns of value addition and export must be involved. The global market of basmati is also highly volatile even though only two competing countries viz. India and Pakistan could join together and amicably share the world market for their mutual benefit.
c. Milk processing units are mushrooming in the state without causing much value addition. However, there is some creditable interference in the state that could provide impetus and direction to development of dairy sector in the state. In terms of institutional interference, Nestlé is an example of facilitating commercial dairy units, encouraging specified fodder production and conservation, providing extension services, spot guidance, systematic marketing etc. and thus captured more volume and better quality of raw material. Strict food laws are needed to check the adulteration and production of spurious milk and

milk product as it has hit the genuine dairy industry hard. In almost every village one or two commercial dairy units should be encouraged and well equipped with necessary services. The emphasis should be on quality milk for meeting the TBT and SPS requirements specified under World Trade Organization.

Table 2: Shift in Cropping Pattern in Punjab

(000 ha)

Crop	1960-61		2008-09	
	Area	Percent of gross cropped area	Area	Percent of gross cropped area
Rice	227	4.80	2802	35.41
Maize	327	6.91	139	1.76
Bajra and Jowar	140	2.96	3	0.04
Groundnut	67	1.42	3	0.04
Cotton	446	9.43	511	6.46
Sugarcane	133	2.81	60	0.76
Kharif Pulses	32	0.68	16	0.20
Sesamum	8	0.17	7	0.09
Wheat	1400	29.59	3522	44.51
Barley	66	1.39	14	0.18
Gram	838	17.71	3	0.04
Rapeseed & mustard	106	2.24	30	0.38
Lentil	30	0.7	0	0.00
Potato	9	0.19	83	1.05
Other vegetables	23	0.49	34	0.43
Fruits	42	0.89	68	0.86
Fodder and others	859	18.15	617	7.80
Total cultivated area	3757	-	4171	-
Gross cropped area	4732	100.00	7912	100.00

d. The production of fruits, vegetables and various other farm products can be accelerated in the state but lack of processing facilities due to their seasonal production nature, high carry over cost and lack of processing attributes are some hindrances.

e. Processing and storage infrastructures for foodgrains have come up with time due to its more or less stable production (Table 3). Similarly for processing of cotton and sugarcane too market processes have come up. However, for fruits, vegetables, milk, meat, fish, etc. such facilities need to come up to gear up their production.

Table 3: Market infrastructure development in Punjab

(Million tonnes)

Parameter	1980-81	2009-10
Regulated markets (No.)	143	146
Average area served per regulated market (Sq km)	352	345
Storage capacity	11.17	25.14
Market arrivals of grains	10.33	33.21
Milk production	32.21	93.89
Processing capacity (`000 litre day^{-1})	3.38	6.18
Animals slaughtered (`000)	462	458

Policy Initiatives Required

Besides economic and environmental pressures, the state agriculture has to diversify to area specific high value enterprises to increase income and employment avenues for the farmers. Domestic market requires functional and instrumental transformation. Liberalization of world market further demands Indian agriculture to redefine the role of farmers' organizations, research institutions and policy planners in order to increase its share in world agricultural exports. Therefore, some policy options required for accelerating the growth of agriculture sector with a view to improve the marketing system are discussed below:

a) The choice in the production-mix of agricultural commodities has to be made in the light of the market requirements not only within the country but also in the global context. The process of production should start from estimating the demand first and then should transcend back to the area to be planted under that crop. The supply based production choices have limited chances of success.
b) Agro-climatic regional planning approach should be followed through demarcation of areas for *basmati* production, durum wheat, desi cotton, vegetables (tomato, potato, chilli, peas, etc.), fruits (grapes and kinnow) cultivation, mentha, celery, agro-forestry, etc. Such potential areas should be developed into effective agri-export zones. Emphasis on less land using enterprises like dairy, poultry, mushroom cultivation and honey production should also be placed to augment the declining incomes of the farmers as well as providing additional employment opportunities.
c) The genetic improvement programmes incorporating attributes of commodities desirable for export and processing should get top priority in the research system.

Unfortunately, our research focus has revolved around yield enhancement only and ignored the quality issues demanded by the international buyers and suitable for processing purposes. It is, therefore, necessary that our products should meet the quality standards of the global market in order to increase exports. Better quality standards can be achieved through promoting organic farming, setting up of quality testing labs, developing varieties which produce quality products, standardization and grading of the products and value addition as well as supplying information and outlook services to the farmers.

d) Though the Punjab agriculture is competitive with the main producing countries in terms of cost of production but the marketing and post harvest handling charges are so high that by the time it reaches the consuming center, the entire comparative advantage is lost. Improving marketing and post-harvest handling efficiency should be the main agenda for the researchers and policy planners to make Punjab products competitive in the world market in terms of prices and quality standards.

e) For providing better market outlook of different consuming and producing countries, a marketing intelligence cell needs to be created which should make available to the exporting agencies the timely, comprehensive and reliable information with respect to quantity and quality requirements, prices, tariffs, etc. The research and extension agencies of the state should gear up to provide technical know-how regarding the production, post harvest handling, processing, marketing etc of exportable commodities.

f) About 10 percent of the geographical area of the state along the Shivalik Hills Range having undulating topography, popularly known as *kandi* belt, is following organic farming of horticulture, vegetables, spices and other crops by default. The establishment of watershed projects, quality testing laboratories, market infrastructure and encouraging farmers' cooperatives in the belt can play vital role promoting diversification and enhancing income of the poor farmers.

g) Contract farming is helpful in protecting the farmers from market uncertainties and thus helps promoting crop diversification. On the other hand, it also ensures supply of quality raw material to the processors. The contract farming in the Punjab state is being promoted to encourage the production of those crops/enterprises for which the price variability in response to production changes is high. However, in the absence of growth in processing facilities, the success of contract farming becomes doubtful. The companies, which are being

roped in as 'buy back' agencies, do not have any processing facilities. Similarly, the marketing infrastructure for these new enterprises is not well-developed to absorb the increased marketable surpluses for these products. Therefore, the cultivation of these crops/enterprises is not picking up as was being envisaged when the scheme was launched in 2002. The agro-processors should be encouraged to enter into direct contract with farmers by involving research and extension systems.

h) The inter-seasonal variation in supply of raw material is the major hurdle in the success of agro-processing units. By exploiting the agro-climatic variation in the region, production calendar for such perishable commodities should be prepared and contract farming accordingly be encouraged. Secondly, multi-utility processing lines should be set up, which could ensure regular supply of the raw materials and operation of the plant throughout the year.

i) Facilities like credit, cool chains from producer to consumer including long distance refrigerated transport, air lifting of perishables, grading and packaging, value addition by processing and proper marketing of these commodities (fresh and processed) in the identified/target market in the domestic as well as international market.

j) Farmers' organizations/associations/cooperatives should be encouraged to take up processing, transport and marketing of produce in domestic and world markets. The farmers, in general, being small and marginal are unable to make huge investments on agro-processing and export their products. The success stories should be replicated for various enterprises, for which the economic viability and potential markets exist.

k) In spite of increasing opportunity for export of agricultural products from developing countries like India, there is growing emphasis on sanitary and phyto-sanitary measures to protect human, animal and plant health. This requires strict legislation with respect to quality and improved processing and packaging facilities. Strengthening quality control measures including adoption of quality check systems for export units and setting up of heat treatment facilities for elimination of pest incubation for products are required in order to gain better access to the overseas markets. The packaging of produce under hygienic conditions, scientific storage of perishable products and processing in desired form play crucial role in promotion of exports. In spite of increasing opportunity

for export of agricultural products, there is increasing stress on sanitary and phyto-sanitary measures to protect human, animal and plant health.

l) The Punjab state has vast production potential of fruits, vegetables, floriculture, meat, milk, fish, spices, forestry, basmati, cotton, mushrooms, etc. There is a need for setting up of dry port with integrated cargo handling cold storage and refrigerated transportation facility in the State for export of such perishable products.

m) The public investments and the marketing system can be tuned to increase and ensure the profitability of other enterprises, which have the potentials but have remained poorly exploited due to weak marketing and economic incentives as compared to rice-wheat system.

n) There is need to develop and continuously update cost-effective, globally competitive and eco-friendly technologies for production, processing and marketing of agricultural, horticultural and livestock products.

CONCLUSIONS

After growing at a fast rate the farm sector of high potential areas is facing serious problem of stagnation. The possibility of second green revolution rests with market development. The farmers, their cooperatives and governments are incapable of doing so. The MNCs with chain stores have attraction and can be useful for ventures. However, there is need for proper analysis about the implications on society before encouraging their large scale entry in the market. The market efficiency in terms of value addition through scientific grading, storage, transportation, packaging, processing, handling, etc. is possible. Not only dwelling upon domestic market expansion, there is need to follow aggressive global marketing for which provision of scientific services for value addition and developing suitable market information and outlook are urgently needed. The major impact of such market developments would bring about diversification of Punjab agriculture and care for balancing the ecological parameters.

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Indian J. Econ. Dev.
Volume 8 No. 2 (2012): 11-26

BASMATI RICE CULTIVATION FOR RESOURCE CONSERVATION AND USE EFFICIENCY IN CONTEXT OF SUSTAINABLE AGRICULTURE IN PUNJAB

D.K. Grover*

ABSTRACT

The present paper studied resource use pattern and economic viability and various biotic and a biotic constraints of basmati rice and non-basmati rice cultivation in the state. The study has been based on the sample of 200 basmati rice growers spreading over five districts of the state during 2008-09.Basmati cultivation saved around 18, 81, 70 and 39 percent irrigation water, urea, DAP and zinc fertilizers respectively as compared to non-basmati rice crop. Basmati rice promised more returns over variable costs to the tune of ` 4562 per hectare over the non-basmati rice. This showed that basmati rice cultivation was both resources conserving as well as better remunerative. The regression analysis has brought out that there existed scope to further increase in the use of human labour, plant population and insecticides/pesticides for improving the yield of basmati rice in the state. The price variability and difficulty to access price related information were the most important marketing problems for basmati rice. Sample farmers wanted that the scientists to evolve new dwarf varieties to minimize the water logging losses. Basmati rice yield needs to be enhanced through genetically improved varieties.To encourage the farmers to increase the area under basmati rice, the goernment need to formulate a policy to ensure adequate support price for basmati rice just on the pattern of non-basmati rice.

INTRODUCTION

India is the second largest producer of rice (more than 20 per cent) in the world next only to China. India has great diversity of food grain crops but rice (*Oryza sativa*) is one of the major food grain crop and also a staple food for majority of the Indian population. India is a natural repository for multitude of long and short-grained aromatic rice, nurtured and conserved by the farmers of northwestern sub Himalayan regions for centuries (Sananse *et al.*, 2004). India produces different types of rice, however two broad classifications known world over have been Basmati

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(Aromatic) and Non-Basmati rice (Ordinary). Basmati rice is enriched with pleasant aroma, long grains with delicate curvature and excellent soft texture. The aroma can be felt in vegetative part in the fields, in the grains during maturity, harvesting, cooking and eating. Aromatic rice have special place in the world rice markets and these are generally the highest priced rice. The leading aromatic rice in the world trade is basmati produced in the Punjab area along both sides of Indus River in India and Pakistan owing to unique environmental, agro climatic and genetic factors. The farmers of Punjab have adopted the rice crop on a large scale only since mid-seventies. Rice which was grown on merely 6.06 per cent of the net cultivated area in 1960-61, registered a steep rise up to about 66 per cent in 2008-09. Barring some areas in the southwestern districts and Kandi belt (sub-mountain), rice is grown all over Punjab. Presently, Punjab with just 1.5 per cent geographical area produces 40 per cent of India's rice and 1 per cent of the world's rice. Basmati rice is mainly grown in Amritsar, Tarn Taran, Gurdaspur, Kapurthala and Hoshiarpur districts of the state. The area under basmati rice has increased over a period of time. It was 0.41 lakh hectares in 1991-92, which increased to 1.25 and 2.40 lakh hectares in 2000-01 and 2008-09 respectively. However, it constituted only 1.98, 4.78 and 8.90 per cent of total rice cultivation in the state.

Punjab Agriculture: Sustainability Challenges

The economic and environmental sustainability of the present cereal based production system based on rice- wheat has become doubtful. The intensive cultivation especially of rice has depleted underground and water, soil fertility reserves, polluted air, water and soils with harmful chemicals and helped in emergence of resistant insect-pests and weeds. The declining profitability of farmers and fast depleting underground water reserves have forced the state policy planners to exploit the possibility of substituting the water galloping crop-rice (Grover, 2009).

The expert group after due deliberation has suggested to shift area from ordinary rice to basmati rice cultivation in the state. Basmati rice, generally planted late in the season (that coincides with the onset of Monsoon) requires relatively less water than the indica rice varieties grown early in the season. In view of concern towards sharply falling water table, it can play an important role in diversification process away from water guzzling high yielding varieties of rice provided it remains remunerative. Moreover, basmati rice has high export potential in the international market. India is one of the principal exporters of basmati rice in the world.Bansil (1993) stated that only 20 per cent of Indian agricultural potential has been exploited.

The production of basmati rice was only about 2 percent of the total production of rice in India. India's only competitor in basmati rice was Pakistan both in terms of price and quality. India can produce better quality basmati rice at cheaper price. Das and Singh (1994) found that India had comparative advantage in exporting rice only in relation to Thailand and since 1988 against Pakistan also, but had comparative disadvantage in relation to China. The study concluded that for increasing exports, India needed to be specialized in production and export of rice particularly of basmati rice. In spite of its low water requirements, better price and export potential, there has been slow increase in area under basmati rice in Punjab. Sandral (1996) worked out the profitability of basmati vis-à-vis non-basmati rice in Punjab and concluded that the overall net returns per hectare were much higher from basmati rice (₹ 11559) as compared to only ₹ 6966 from non-basmati rice cultivation. It, therefore, becomes pertinent to examine the biotic as well as a-biotic factors responsible for slow expansion of basmati acreage in Punjab which otherwise is considered as desirable both in terms of profitability as well as sustainability of the state agriculture. The present study has therefore, been carried out to look in these issues in depth. The specific objectives of the study were:

i. to analyze the resources management practices of basmati and non-basmati rice cultivation in Punjab,
ii. to study the economics and resource use efficiency of basmati in relation to non-basmati rice in the state,
iii. to examine the various biotic as well as a-biotic constraints confronted by basmati and non-basmati cultivators and
iv. to put forward various policy suggestions to boost basmati cultivation for resource conservation in context of sustainable agriculture in the state.

METHODOLOGY

To accomplish the various objectives of the study, primary data at farmers' field were required. The Punjab state being dominant in cereal-based cropping system has been selected as the study area. Based on the concentration of basmati cultivation, the study covered five districts namely, Amritsar, Tarn Taran, Gurdaspur, Kapurthala and Hoshiarpur, which taken together constituted about 95 percent of total basmati and 25 percent of total non-basmati rice cultivation in the state. From each selected district, one Tehsil/block with maximum concentration of basmati rice cultivation

was selected for the field level data. A sample of 200 farmers growing both basmati as well as non-basmati rice spreading over five districts was taken for the study. The required information and data pertaining to the parameters such as cropping pattern, input use pattern, cost and return and production constraints/perception of basmati and non-basmati rice cultivation, etc. pertaining to year 2008-09were collected from the sample farmers with the help of an especially designed schedule. The regression analysis was carried out to study the yield response of basmati and non-basmati rice in the state. The constraint analysis was also carried out using weighted average ranking method. The interpretation of data was based on simple tabular analysis.

Benefit-cost Analysis of Basmati/ Non-basmati Rice

In order to estimate the cost of production of basmati and non-basmati rice, the various inputs purchased from the market were valued at the actual price paid by the farmers and the home produced inputs like seed, FYM, etc. were estimated at the prevailing market prices for such inputs in the local market in a particular area. The family labour and owned machine used at the farm were assessed at the engaging wage rate for hiring casual labour and the prevailing custom hiring charges for such machines during survey period. The interest on the total variable cost was taken @ 10 per cent per annum for half of the crop period. The total output including both main product as well as by-product was evaluated at the market prices, actually realized by the farmers. The total cost included human labour (family plus hired) for all the farm operations, machine expenses (owned plus hired) for all the farm operations, seed (farm produced plus purchased) and seed treatments, insecticides-pesticides, manures and fertilizers, irrigation charges, interest on working capital. The gross income per hectare of basmati and non-basmati rice crop was worked out by multiplying per hectare production of main product and by-product with their respective post-harvest period prices. The net income has been calculated by deducting total cost from gross income per hectare.

Yield Response Function-Regression Analysis

In order to study the yield response of basmati and non-basmati rice, Cobb-Douglas production function (Power function) and Linear production function were tried taking the dependent variable (Yield of basmati rice or non-basmati rice / hectare) and various independent variables like human labor, machine use, seed, fertilizer, insecticides/pesticides, fertilizers, herbicides, etc. in value term (` ha^{-1}) separately for basmati and non-basmati rice. The followinglinear regression model

was found better fit in terms of the value of coefficient of multiple determinations, level of significance and logical signs of different independent variables for basmati as well as non-basmati rice crops:

$$Y = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + a_5x_5 + a_6x_6 + a_7x_7 + u$$

Where,

Y = Yield of basmati rice or non − basmati rice per hectare

x_1 = Human labour

x_2 = Machine labour

x_3 = Seed

x_4 = Seed treatment

x_5 = Insecticides/pesticides

x_6 = Manures and fertilzers

x_7 = Irrigation

a_0 = Intercept

a_{is} = Regression coefficients of respective independent variables

u = Error term

Independent variables were tested for their stochastic independence.

RESULTS AND DISCUSSION

The results obtained after the analysis of data have been discussed under the following sub-heads as under:

Varietal Distribution of Basmati Rice

Varietal shift of area under basmati rice in Punjab brings out that of the total area under basmati rice in 2005-06, maximum area (29.56 per cent) was under Pakistani Basmati followed by Basmati 386 (24.52 per cent), Super basmati (17.72 per cent) and Basmati 3000 (9.50 per cent). The other popular varieties grown in the state were Pusa basmati, Basmati 1121 etc. In the subsequent years (2008-09), area under Pakistani basmati increased to 31.74 per cent, followed by Super Basmati (21.63 per cent), Basmati 3000 (13.80 per cent) and Basmati 1121 (11.96 percent). The results showed that during this short span, varieties like Super basmati; Basmati 3000 became more popular among the basmati growers in the Punjab**.**

Resource Use Pattern for Basmati and Non-Basmati Rice Cultivation

The resource use pattern of basmati and non-basmati rice cultivation is discussed under different sub-heads as under:

Nursery growing/transplantation operations

Various agronomic practices such as land preparation, sowing time, seed treatment, fertilizers application, irrigation, etc. adopted for nursery growing by the sample farmers for basmati and non-basmati rice cultivation have been studied. About 81 percent basmati rice nursery was sown in the first fortnight of June whereas about 97 percent non-basmati rice nursery was sown by the first fortnight of May. Nursery sowing of basmati rice is delayed by about one month as compared to non-basmati rice in the study area. In regards to fertilizer uptake, for basmati rice it was 118.61 kg per hectare urea as compared to276.76 kg per hectare for non-basmati rice. There was no significant differences in use of DAP and Zinc across basmati and non-basmati rice crops at the nursery raising level. The average number of irrigation applied to nursery of basmati rice and non-basmati rice crop were 7.9 irrigations and 10 respectively. Thus, net saving of two irrigations has been observed in the case of basmati rice nursery. On the whole, it has been found that the basmati rice crop was resource saving as compared to non-basmati rice crop. The maximum nursery transplanting of basmati rice in the main fields has been practiced in the first and second week of July, whereas this activity was performed in the first and second week of June for non-basmati rice. The nursery transplanting of basmati rice was delayed by a month time that coincides with monsoon arrivals and hence less pressure on the underground water unlike non-basmati rice cultivation in the state.

Post transplanting operations

Various post-transplanting operations such as irrigations and fertilizer applications performed by sample farmers for basmati and non-basmati rice in the state brings out that only 18.8 irrigations were applied to basmati as compared to 25.6 irrigations to non-basmati rice crop (Table 1). Though the time of irrigation for basmati rice was higher (12.2 hr ha^{-1}) as compared to non-basmati rice crop (10.9 hr ha^{-1}), yet a net saving of about 18 percent water has been found in the case of basmati cultivation as compared to non-basmati rice. The results pertaining to the fertilizer applications showed that there was about 81 per cent saving in urea, 70 per cent DAP and 39 per cent saving of zinc was observed in case of basmati cultivation as compared to non-basmati rice crop (Table1).

Benefit-cost analysis of basmati/ non-basmati rice

The gross return from per hectare production of basmati and non-basmati rice was ` 58600 and ` 54585 on the farms of basmati growers (Table 2). The respective total variable costs of cultivation per hectare were ` 16629.4 and ` 17176.2. The table further showed that the basmati rice crop promised returns over variable costs of ` 41970.6 as compared to ` 37408.8 from non-basmati rice during the year of study. The gap between the returns over variable costs (ROVC) between the two rice crops (basmati and non-basmati) has been observed as ` 4561.8 per hectare. The input wise analysis showed the basmati as resource saving crop as compared to non-basmati crop. Although cost of human labour was more (` 4860.2 per hectare) as compared to ` 3100.4 per hectare on non-basmati crop but the costs on machinery (₹ 5850.3 per hectare), Manure and fertilizers (` 1480.2 per quintal), Irrigation costs (` 564.6 per hectare) were less. Though, the yield was quite lower (25.6 q $ha^{-1}$) in the case of basmati rice as compared to non-basmati rice (58.5 q $ha^{-1}$) yet, it was highly compensated by the premium price of basmati rice (` 2218.5 per quintal) as against only ` 930 per quintal for non-basmati rice. On the whole, it was found that basmati rice cultivation was both resources conserving as well as more remunerative in relation to non-basmati rice.

Yield response function- Regression Analysis

The results brought out that in the case of basmati crop, the regression coefficient of seed was positive (15.07) and significant at one per cent level, which implied that with an increase of seed by one ₹, the resultant yield would increase by ₹ 15 per hectare. Similarly, the positive and significant (one per cent level) coefficient of human labor showed that the additional ₹ one spent on machine labor would enhance the yield by ₹ 2.89 per hectare. The coefficient of insecticides-pesticides (3.11), which has been found statistically significant at 5 per cent level, indicated that the additional spending of ₹ one on this variable would result into an increase of yield of basmati by ` 3.11 per hectare. The value of R^2 (0.42) found in the case of basmati rice cultivation showed that all the independent variables included in the model, taken together, explained about 42 per cent of variation in the dependent variable (Yield per hectare). The remaining variation may be due to those factors that have not been captured in the model.

In the case of non-basmati rice the value of R^2 was observed as 0.52, implying that about 52 per cent variations in the yield of non-basmati rice could be explained by these explanatory variables, taken together. The coefficients of

explanatory variables viz., insecticides-pesticides, manures-fertilizers and irrigation were found to be positive and statistically significant, though at higher level of 5 per cent showing the further scope of enhancing the yield value of non- basmati rice per hectare through increasing the dose of these inputs. On the whole, there was a need to further increase the use of human labour, plant population and insecticides/pesticides for improving the yield of basmati rice and insecticides /pesticides, manures/ fertilizers for improving the yield of non-basmati rice in Punjab. In context of resource conservation and sustainable agriculture particularly in terms of irrigation water uses, the regression results bring out clearly that the irrigation coefficient turned out as significant in case of non-basmati rice while non-significant for basmati rice cultivation in the state.

Constraint Analysis

The various rice production constraints, biotic (insect-pests, disease, weeds), a biotic constraints (lack of irrigation facility, non-availability of quality seeds, non-availability of fertilizers, shortage of labour, lack of credit, low yield, etc.) and marketing constraints (price variability, storage losses, transport, market demand, etc.) as perceived by the farmers for basmati and non-basmati rice were studied.

Biotic constraints: The problem of occurrence of stem borer was 'moderate' for 48 percent basmati and 51.6 per cent non-basmati rice growers as per the perception of sample growers.

The crop of five per cent basmati and 6.6 per cent non-basmati rice growers was attacked by Rice hispa, as a result of which 1.6 per cent of basmati and 2.2 per cent yield of non-basmati rice have decreased. The leaf folder has affected 8.3 percent basmati and 6.7 percent non-basmati area resulting in loss of 8.00 and 6.1 percent yield of basmati and non-basmati rice. According to the perception of rice growers there was no problem of plant hopper on basmati rice, whereas, 6.6 per cent non-basmati rice grower were perceived it as 'moderate' problem as shown in Table 4.

Diseases were other problem: As per the perception of sample farmers, the yield losses for basmati ricedue to Blast and Foot Rot were 5.1 and 1.3 per cent, respectively (Table 5). The other diseases like Bacterial Leaf Blight and False Smut did not emerge on basmati crop, but it caused 2.1 per cent yield loss to non-basmati crop. Hence, Bacterial Leaf Blight and False Smut for non-basmati rice and Foot rot for basmati rice were the major problematic diseases. About 6.3 and 2.7 per cent area

of non- basmati rice was affected by Bacterial Leaf Blight and False Smut respectively.

Abiotic constraint: The occurrence of other major a-biotic stress such as water logging etc during last 10 years in the rice field of the sample rice growers has been given in Table 6. The yield losses due to water logging in basmati and non-basmati rice were 15 per cent and 2.6 per cent, respectively. As regards the water logging 21, 16 and 14 per cent farmers faced 'moderate', 'severe' and 'slight' problem, respectively in basmati crop. Similarly 22 per cent farmers consider this problem as 'slight' for non-basmati rice crop. The yield loss due to weeds as perceived by the sample farmers was 0.90 and 1.04 per cent in basmati and non-basmati rice on the farms of basmati growers and 1.2 per cent on the farms of non-basmati rice growers. The problem of weeds, as experienced by the basmati and non-basmati rice growers was not very serious. The intensity of weeds simply varied from 'slight' to 'moderate' across majority of the farmers under the year of study.

Input constraints: Low yield, non-availability of disease resistant varieties, lack of irrigation facilities and non-availability of quality seeds were the major input constraints as reported by the basmati rice and non-basmati rice growers (Table 7). The other input constraints for basmati and non-basmati rice crop in order of importance were found to be shortage of labour, non-availability of fertilizers, lack of credit, non-availability of chemicals/ pesticides on the farms of basmati rice growers, whereas in case of non-basmati rice, order of important constraints were shortage of labour, lack of credit, non-availability of fertilizers, non-availability of machinery, non-suitable land and non-availability of chemical/pesticides during the period of study.

Marketing constraints: Price variability, lack of price information, losses during storage, high labour needs for sowing / packaging, transport to market etc. as presented in Table 8 were the important marketing constraints, highlighted by the sample basmati growers for their basmati and non-basmati rice crops. Price variability and difficulty in accessing price related information were the most important marketing problems for basmati rice. Some other moderate marketing problems in order of importance were transportation to market, high labour needs for sorting/ packaging, loss of basmati during storage perceived by the sample basmati growers. On the other hand, transport to market and high labour needs for sorting/package were emerged as major marketing problems for non-basmati rice in the study area.

Desired farm practices to increase the yield: The most desired practices for increasing the yield of basmati and non-basmati rice crops at farmers level viz. increase the plant population, use more fertilizer, timely planting, timely weeding, irrigation at proper time and use of proper plant protection measures, offered to the respondents have been put in Table 9. Timely planting, use of proper plant protection measures and providing irrigation at the right time were the most desired practices the farmers were adopting for yield improvement. Other practices in order of importance were increasing plant population, timely weeding and use of higher dose of fertilizers in case of basmati rice, and use of fertilizers, increasing plant population and timely weeding for non-basmati rice. The sample farmers expected from agricultural scientists to develop high yielding, pest resistant and low input requiring varieties of non-basmati rice whereas dwarf high yielding varieties of basmati rice (Table 10).

CONCLUSIONS

Based on the analysis, cultivation of basmati rice requires around 30 percent less water as compared to non-basmati rice. The maximum transplanting of basmati rice was practiced in the first and second week of July, whereas this activity was performed for non-basmati rice in the first and second week of June. The transplanting of basmati rice was almost delayed by a month time that coincides with monsoon arrivals and hence put less pressure on the underground water unlike non-basmati rice cultivation in the state. Regarding fertilizer applications, about 81 per cent saving in urea, 70 per cent DAP and 39 per cent saving of zinc was observed in case of basmati rice cultivation as compared to non-basmati rice crop. Basmati rice promised returns over variable costs of ` 41970.6 as compared to ` 37408.8 from non-basmati rice during the year of study. Input use practices showed basmati rice as resources saving as compared to non-basmati crop. Manure and fertilizers (` 1480.2 per hectare), Irrigation costs (` 564.6 ha^{-1}) were less. Though, the yield was quite less (25.6 q ha^{-1}) in the case of basmati rice as compared to non-basmati rice (58.5 q ha^{-1}) yet, it was more than compensated by the premium price of basmati rice (` 2218.5 $q^{-1}$) as against only ` 930 per quintal for non-basmati rice. On the whole, it was found that basmati rice cultivation was both resources conserving as well as better remunerative in relation to non-basmati rice. In context of resource conservation and sustainable agriculture particularly in terms of irrigation water uses, the regression

results bring out clearly that the irrigation coefficient turned out as significant in case of non-basmati rice while non-significant for basmati rice cultivation in the state. Hence, there existed scope to further increase irrigations in case of non-basmati rice while no further scope for more irrigations in basmati rice. The yield losses due to water logging in basmati rice were much more than non-basmati rice. The major desired areas of research from agricultural scientists to increase the yield of basmati rice as perceived by sample farmers were to develop high yielding dwarf varieties. Besides, Government supported market price, contract farming, etc. can go a long way to expand basmati rice acreage in the state for resource conservation and sustainable agriculture.

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Table 1: Various post-transplanting operations done by the sample basmati rice growers in Punjab

(Kg ha^{-1})

Particulars	Basmati growers	
	Basmati rice	**Non-Basmati rice**
Irrigations		
Number	18.8	25.6
Time(Hr ha^{-1})	12.2	10.9
Fertilizers applications		
Urea	54.8	282
DAP	33.1	111
Zinc	9.1	15
Basal doze		
Urea	30.0	140
DAP	33.1	90.9
Zinc	9.1	15
Top dressing-I		
Urea	24.8	95.1
DAP	-	6.8
Top dressing-II		
Urea	-	46.8

Table 2: Economics of basmati / non-basmati rice on the sample basmati rice growers in Punjab

(` ha^{-1})

Particulars	Basmati Growers	
	Basmati rice	**Non-Basmati rice**
Variable costs		
1. Human Labour	4860.2	3100.4
2. Machine Expenses	5850.3	6887.2
3. Seed and seed treatment	561.2	332.3
4. Insecticides and Pesticides	2497.6	2276.2
5. Manures and Fertilizers	1480.2	3336.8
6. Irrigation	564.6	817.1
7. Interest on working capital	415.3	426.2
Total variable cost	**16629.4**	**17176.2**
Yield (q ha^{-1})	25.6	58.5
Price (` q^{-1})	2218.5	930
Value of main product	56793.6	54405
By-product (q ha^{-1})	38.6	6.0
Price (` q^{-1})	46.8	30.0
Value of by-product	1806.4	180.0
Gross returns	**58600**	**54585**
Net returns over variable cost	**41970.6**	**37408.8**

Table 3: Results of linear regression of the sample basmati rice growers in Punjab

Particulars	Basmati Growers	
	Basmati rice	Non-Basmati rice
Yield in value terms		
1. Constant	18551.2**	11679.5**
	(4605.73)	(2137.43)
2. Human Labour	2.89***	-0.64NS
	(0.24)	(0.38)
3. Machine Expenses	-2.02	0.22NS
	(1.31)	(0.65)
4. Seed	15.07***	5.04NS
	(4.17)	(11.47)
5. Seed treatment	9.85	21.33NS
	(85.99)	(52.85)
6. Insecticides & Pesticides	3.11**	2.05**
	(1.36)	(0.76)
7. Manures & Fertilizers	0.03NS	0.69**
	(0.82)	(0.30)
8. Irrigation	13.49NS	13.31**
	(10.72)	(5.36)
R^2	**0.42**	**0.52**

Figures in parentheses indicate the standard error
****and ** significant at 1 and 5 percent level respectively.NS: Non-significant***

Table 4: Frequency of occurrence of major insect-pests during last 10 years in the field of the sample basmati and non-basmati rice growers in Punjab

(Percent growers)

Particulars	Basmati Growers	
	Basmati rice	Non-Basmati rice
1. Stem borer		
Slight	14.0	16.5
Moderate	48.0	51.6
Severe	3.0	1.1
Area affected (Percent)	11.3	10.7
Yield declined (Percent)	10.0	9.8
2. Rice hispa		
Slight	4.0	3.3
Moderate	5.0	6.6
Severe	1.0	1.1
Area affected (Percent)	1.2	1.9
Yield declined (Percent)	1.6	2.2
3. Leaf folder		
Slight	6.0	5.5
Moderate	30.0	26.4
Severe	5.0	3.3
Area affected (Percent)	8.3	6.7
Yield declined (Percent)	8.0	6.1
4. Plant hopper		
Slight	-	3.3
Moderate	-	6.6
Severe	-	1.1
Area affected (Percent)	-	1.5
Yield declined (Percent)	-	1.1

Table 5: Frequency of occurrence of major diseases during last 10 years in the rice field of the sample basmati growers in Punjab

(Percent growers)

Particulars	Basmati Growers	
	Basmati rice	Non-Basmati rice
Bacterial leaf blight		
Slight	-	16.5
Moderate	-	19.8
Severe	-	1.1
Area affected (Percent)	-	6.3
Yield declined (Percent)	-	5.9
False smut		
Slight	-	12
Moderate	-	13
Severe	-	-
Area affected (Percent)	-	2.7
Yield declined (Percent)	-	2.1
Blast		
Slight	18.0	6.6
Moderate	16.0	4.4
Severe	1.0	-
Area affected (Percent)	5.1	1.3
Yield declined (Percent)	5.1	1.3
Foot rot		
Slight	3.0	-
Moderate	6.0	-
Severe	-	-
Area affected (Percent)	1.3	-
Yield declined (Percent)	1.3	-

Table 6: Frequency of occurrence of other major a biotic stresses during last 10 years in the rice field of the sample rice growers in Punjab

(Percent growers)

Particulars	Basmati Growers	
	Basmati rice	Non-Basmati rice
Water logging		
Slight	14.0	22.0
Moderate	21.0	8.8
Severe	16.0	-
Area affected (Percent)	16.0	3.1
Yield declined (Percent)	15.0	2.6
Weeds (Broad leaf/ Annual grasses)		
Slight	8.0	7.7
Moderate	5.0	7.7
Severe	-	-
Area affected (Percent)	0.95	1.15
Yield declined (Percent)	0.90	1.04

Table 7: Various abiotic constraints faced by the sample basmati rice growers in Punjab

(Weighted rank)

Particulars	Basmati Growers	
	Basmati rice	Non-Basmati rice
Lack of irrigation facility	1.0	1.1
Non-availability of quality seeds	1.0	1.0
Non-availability of fertilizers	0.5	0.4
Non-availability of chemicals/ pesticide	0.2	0.3
Shortage of labour	0.9	1.0
Non-Availability of machinery	0.1	0.1
Lack of credit	0.4	0.3
Non suitable land	0.1	0.1
Low yield	1.6	1.4
Non availability of disease resistant varieties	1.2	1.2

Note: Rank 1=3, Rank 2=2, and Rank 3=1.

Table 8: Marketing problems faced by the basmati rice growers in Punjab

(Weighted rank)

Particulars	Basmati Growers	
	Basmati rice	Non-Basmati rice
Difficult to access price related information	1.6	-
Price variability	1.9	-
Losses of basmati during storage	0.3	-
High labor needs for sorting /packaging	0.6	0.3
Transport to market	0.7	0.4
Low market demand	0.1	-

Note: Rank 1=3, Rank 2=2, and Rank 3=1.

Table 9: Perceptions of the sample basmati rice growers with regard to yield enhancement possibilities at their own level in Punjab

(Weighted rank)

Particulars	Basmati Growers	
	Basmati rice	Non-Basmati rice
Increase the plant population	0.7	0.7
Use more fertilizer	0.4	1
Timely planting	2	1.9
Timely weeding	0.5	0.5
Provide irrigation at the right time	1.2	1.0
Use proper plant protection measures	1.2	0.9

Note: Rank 1=3, Rank 2=2, and Rank 3=1.

Table 10: Multiple suggestions given by the sample basmati rice growers that what researchers should do to increase the yield in Punjab

(Multiple responses)

Particulars	Basmati Growers	
	Basmati rice	Non-Basmati rice
High yielding varieties	31.0	52.7
Dwarf varieties	56.0	-
Pest resistant varieties	15.0	16.5
Low input requiring varieties	16.0	27.6

Indian J. Econ. Dev.
Volume 8 No. 2 (2012): 27-39

INPUT USE AND PRODUCTIVITY DIFFERENTIALS IN WHEAT CROP IN PUNJAB

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ABSTRACT

The significant variation in the use of crucial inputs resulting into huge variation in wheat productivity across farmswas observed. The yield of wheat ranged between 2017 and 6122 kg per ha with an overall average of 4434 kg per ha. The percent of farmers who obtained a productivity level of less than 3000kg per ha was 10, whereas 14 percent farmers had realised more than 5000 kg per ha. The wheat crop sown up to the first week of November yielded the highest productivity. Similarly, the farmers who applied six irrigations had obtained the highest level of wheat productivity. Though the use of fertilsers above the recommended dosages affected the productivity positively, their application needs to be regulated keeping in view soil testing reports. The production function analysis revealed that sowing time, irrigation, nitrogen application and expenditure on plant protection chemicals were the major determinants of wheat productivity.

INTRODUCTION

The economy of the Punjab state is largely dependent on wheat crop which covered about 44 per cent of the gross cropped area and about 85 per cent of the area under *rabi* crops during 2008-09. This tiny state with only 1.54 percent of the total geographical area of the country has contributed about fifty to seventy percent towards the central pool of the wheat grains for last two decades. Wheat production trends in Punjab indicated that the area under wheat cultivation in 1970-71 was 21.66 lakh ha which increased to 35.22 lakh ha in 2009-10. During same time period, productivity increased from 2245 to 4307 kg per ha, which was the highest in our country. As a result of increase both in area and productivity, the production of wheat in the state rose from 48.65 lakh tonnes in 1970-71 to 151.72 lakh tonnes in 2009-10. On an average the area

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under wheat, production and productivity increased with a growth rate of 1.33, 4.16 and 2.77 per cent, respectively. During first three decades (1970-2000), the area, production and yield of wheat increased with a decelerating compound annual growth rates and ultimately became almost stagnant since the last decade with some variations (Anonymous, 2010). Thus, in view of the no scope of further increase in area under the crop, wheat production in the state has reached plateau and without new technological breakthrough it may not increase significantly in the coming times.

Though, the state has achieved a breakthrough in the adoption of available wheat production technology, yet it has been observed that there are significant variations in productivity between different regions and even from farm to farm within the same region (Dhaliwal *et al*., 2005). Moreover, now the stage is reached in state when crop is being grown with high doses of various inputs and, thus, further additions to production are beset with increasing costs. Thus, the scope for increasing wheat production as well as farm income in the State lies in exploring the possibilities of improving the productivity of low productivity regions/farms through the rationalization of input use on farms making sub-optimal use of inputs. In the back drop of this, the present study was undertaken to make an elaborative enquiry on the extent of variations in use of important inputs and resulting productivity differentials between different agro climatic zones as well as among farmers in each zone of the state.

METHODOLOGY

The farm level data relating to production of wheat in Punjab were taken from the centrally sponsored project *Comprehensive scheme to study the cost of cultivation of principal crops in Punjab*being managed by the Department of Economics and Sociology, Punjab Agricultural University, Ludhiana. Under this scheme, the Punjab state is divided into three agro-climatic zones. Zone I lies in north and north-west side of the state covering about 42 per cent of the cultivated area. Zone-II comprises the central part of the state covering about 27 per cent of the cultivated area. Wheat in *rabi* and paddy in *kharif* are the important crops grown in Zone-I and II with tube well as main source of irrigation. Zone-III is located in south-western part of the state which is comparatively dry area with canal as major source of

irrigation and is also known as cotton-wheat zone. It covers about 31 per cent of total cultivated area of state. From each zone the sample farmers have been selected using three stages stratified sampling technique, with tehsil at stage one, a village or cluster of villages at second stage and operational holdings within the cluster as the third and final stage of the sample selection. From each cluster, a sample of 10 operational holdings, two each from the five size classes viz. marginal (< 1 ha), small (1-2 ha), semi-medium (2-4 ha), medium (4-6 ha) and large (> 6 ha) are selected. Thus, 300 farm holdings are selected from the 30 tehsils of the state to study the cost of cultivation of principal crops. However, for the present study, six tehsils were randomlyselected from each agro-climatic zone. At the next, stage two farm holdings representing each of the five size classes given as above were chosen randomly from each sample tehsil for the year 2008-09. Thus, the total sample consists of 180 farm holdings; comprising 60 farmers each from the six sample tehsils from each agro-climatic zone. Wheat productivity differentials were studied in relation to the actual use of important inputs through simple tabular analysis using averages and percentages.

The production function technique was used to examine the elasticities of wheat productivity with respect to the important inputs used in its production. Different forms of production functions were tried. Finally, the log-linear function was retained on the basis of the value of the Coefficient of Multiple Determination (R^2), the sign and significance of the parameter estimates, which were meaningful and logically explainable. The production function model used is described as under:

$$Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} e^u$$

Where;

Y= Wheat productivity ($kgha^{-1}$)

X_1= Total human labour use ($hrha^{-1}$)

X_2= Sowing time taken as discreet variable.

1 was given for sowing in month of October

2 for sowing in 1st week of November

3 for sowing in 2nd week of November and so on

X_3= Irrigation (numbers)

X_4= Nitrogen application (nutrient $kgha^{-1}$)

X_5= Phosphorus application (nutrient kgha^{-1})
X_6= Expenditure on plant protection chemicals (`ha^{-1})
$b_1$to b_6= Regression parameters
a= Constant term
u= Error term

The independent variables were tested for their stochastic independence.

RESULTS AND DISCUSSION

The frequency distribution of farmers in respect of the productivity level during the study year revealed a significant proportion of farmers in the State still operating at the low level of wheat productivity (Table 1). While about 64 per cent of the state farmers realized wheat productivity in the range of 4000 to 5000 kg per ha, about one fourth farmers received yield levels less than 4000 kg per ha. At the same time, exceptionally good productivity level (above 5500 kg per ha) was achieved by about 8 per cent farmers.

Table 1: Frequency distribution of wheat farmers in respect of productivity in Punjab, 2008-09

(Kg ha^{-1})

Productivity	Number of Farmers			
	Zone I	Zone II	Zone III	Overall
< 2500	5	-	-	5
	(8.33)			(2.78)
2500-3000	4	-	-	4
	(6.67)			(2.22)
3000-3500	5	3	1	9
	(8.33)	(5.00)	(1.67)	(5.00)
3500-4000	7	8	11	26
	(11.67)	(13.33)	(18.33)	(14.44)
4000-4500	21	16	15	52
	(35.00)	(26.67)	(25.00)	(28.89)
4500-5000	13	27	19	59
	(21.67)	(45.00)	(31.67)	(32.78)
5000-5500	5	5	7	17
	(8.33)	(8.33)	(11.67)	(9.44)
>5500	-	1	7	8
		(1.67)	(11.67)	(4.44)
Sample size	60	60	60	180
	(100)	(100)	(100)	(100)

Figures in parentheses indicate the percentages of farmers

The proportion of farmers receiving low wheat productivity (less than 4000 kg per ha) was found to be low in the case of Zone-II and III, while it was quite higher in Zone-I. On the other hand, proportion of farmers getting very high productivity (above 5000 kg per ha) was relatively large in Zone-III followed by Zone-II and I respectively. The results showed that the yield of sample farmers ranged between 2017 and 6122 kg per ha with an overall average at 4434 kg per ha in the State (Table 2). Average productivity was found to be the highest in Zone-III (4652 kg per ha) followed closely by zone II (4516 kg per ha) whereas it was relatively low to the tune of only 4105 kg per ha in Zone-I. The difference between the highest productivity and lowest productivity achieved on farms was also found to be the highest in Zone-I (about 3303 kg per ha). The use of important inputs like urea, di-ammonium phosphate (DAP), human labour, insecticides and irrigation on per ha basis was also relatively lower in Zone-I as compared to other two zones of the state.

Table: 2. Use of important inputs and wheat productivity in Punjab, 2008-09

Particulars	Unit (ha^{-1})	Zone I	Zone II	Zone III	Overall
Average Productivity	kg	4105	4516	4652	4434
Maximum Productivity	kg	5320	5531	6122	6122
Minimum Productivity	kg	2017	3124	3375	2017
Seed	kg	100.62	100.79	100.7	100.7
FYM	q	8.77	0.77	7.79	5.79
Urea	kg	2.86	3.18	3.15	3.07
DAP	kg	1.25	1.6	1.34	1.4
Weedicides	`	942.51	976.26	645.45	849.51
Insecticide	`	144.94	179.1	354.61	229.99
Tractor	hr	15.26	14.34	14.78	14.79
Irrigation	No.	3.22	4.83	5.55	4.73
Human Labour	hr	133.26	150.86	186.89	158.97

The extent of variation in wheat productivity among the farmers with respect to the use of inputs is discussed under different sub-heads as follows:

Sowing Time

The sowing time is the most important non-monetary input which has great influence on productivity of resources used in crop production**.** The results presented in Table 3revealed that about 65 per cent of the sample farmerscompleted wheat sowing by the second week of November; another

30 per cent by the end of November and the rest about five per cent after this period. The wheat productivity was the highest (> 4700 kg per ha) when sown till 1st week of November andshowed a drastic decline with subsequent delay in its sowing. The same phenomena of negative relationship between the time of sowing and wheat productivity was observed in zone-wise analysis. Thus, results showed the existence of ample scope to raise the average wheat productivity in the state through advancement of its sowing time towards the early part of November month. However, wheat followed by cotton and basmati gets delayed resulting in decline of average productivity in the state.

Table 3:Wheat yield in relation to the sowing time, Punjab, 2008-09

(Kg ha^{-1})

Sowing time	Zone I		Zone II		Zone III		Overall	
	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield
October	2 (3.33)	4830	-	-	8 (13.33)	4739	10 (5.56)	4758
1st week of November	13 (21.67)	4649	14 (23.33)	4779	8 (13.33)	4877	35 (19.44)	4752
2nd week of November	25 (41.67)	3965	35 (58.33)	4382	12 (20.00)	4754	72 (40.00)	4299
3rd week of November	14 (23.33)	3700	10 (16.67)	4282	11 (18.33)	4543	35 (19.44)	4131
Last week of November	1 (1.67)	4289	1 (1.67)	3647	16 (26.67)	4408	18 (10.00)	4363
1st week of December	2 (3.33)	3040	-	-	5 (8.33)	3661	7 (3.89)	3483
2nd week of December	3 (5.00)	3083	-	-	-	-	3 (1.67)	3082
Sample size	60 (100)	-	60 (100)	-	60 (100)	-	180 (100)	-

Figures in parentheses indicate the percentages of farmers

Irrigation

Irrigation being the most crucial input in agriculture shifts the response surface upwards as well as it determines the nature of response curve for other crucial inputs also. Misuse of irrigation water not only leads to its wastage but also reduces the efficiency of fertilizers and other inputs (Prihar and Sandhu, 1987). The perusal of Table 4 showed that up to 6th irrigation the wheat yield has shown positive relationship with number of irrigations and thereafter the yield showed declining trend. It was found that about 22 percent farmers have applied six irrigation and obtained highest yield (4672 kg per ha). On the other hand, about 40 percent farmers

applied four or less irrigations and obtained relatively low yields. Further, about 12 per cent farmers applied three or less number of irrigations with average productivity at the most 3401 kg per ha. Across the zones, the analysis showed that while proportion of farmers applying very low number of irrigations (3 or less) was negligible in Zone-I and II, in Zone-I about 32 per cent farmers were operating at this level and getting comparatively very low productivity for their wheat crop.

Table 4: Wheat productivity in relation to irrigation intensity, Punjab, 2008-09

(Kg ha^{-1})

Irrigations (No.)	Zone I		Zone II		Zone III		Overall	
	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield
≤2	5 (8.33)	2954	-	-	1 (1.67)	3823	6 (3.33)	3099
3	14 (23.33)	3423	2 (3.33)	3249	-	-	16 (8.89)	3401
4	27 (45.00)	4237	22 (36.67)	4318	4 (6.66)	4427	53 (29.44)	4285
5	13 (21.67)	4223	25 (41.67)	4594	19 (31.67)	4459	57 (31.67)	4464
6	1 (1.67)	4705	9 (15.00)	4635	30 (50.00)	4680	40 (22.22)	4672
7	-	-	2 (3.33)	4343	6 (9.99)	4354	8 (4.44)	4351
Sample size	60 (100)	-	60 (100)	-	60 (100)	-	180 (100)	-

Figures in parentheses indicate the percentages of farmers

Application of Fertilizers

Fertilizers being an indirect substitute for land are important inputs, particularly the nitrogenous and phosphatic ones. For wheat crop 125 kg of nitrogen and 62.5 kg of phosphorus per ha are recommended under the normal conditions. Although Punjab uses the highest dose of fertilizers amongst the Indian states, it is still far lower than in many other countries of the world where the agricultural productivity is even higher (Singh, 1996). The sample farmers applied varying doses of major nutrients to wheat crop which are depicted in Table 5 and 6.

The results regarding use of nitrogen and its impact on wheat productivity showed that about 24 per cent farmers applied 110 to 140 kg of this nutrient which is considered close to the recommended level and got average productivity of 4234 kg per ha. However, major proportion of farmers (32.78 per cent) applied nitrogen in the range of 140-170 kg per ha with relatively higher average productivity level of 4377 kg per ha. It was noticed that about 42 per cent of farmers, who had applied nitrogen

more than 170 kg per ha without significant additional gains in terms of yield increase. Thus, study clearly indicated over use of nitrogenous fertilizers in wheat cultivation leading to increased cost of production. The proportion of farmers using excessive dose of nitrogen (more than 170 kg per ha) was the highest in Zone-II (48.33 per cent), followed by Zone-III (45 per cent) and Zone-I (33 per cent).

Table 5: Wheat productivity in response to nitrogen use, Punjab, 2008-09

(Kg ha^{-1})

Dosage	Zone I		Zone II		Zone III		Overall	
	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield
80-110	2 (3.33)	3953	-	-	-	-	2 (1.11)	3953
110-140	23 (38.33)	4132	7 (11.67)	3985	13 (21.67)	4547	43 (23.89)	4234
140-170	15 (25.00)	4093	24 (40.00)	4424	20 (33.33)	4534	59 (32.78)	4377
170-200	12 (20.00)	3889	14 (23.33)	4586	23 (38.33)	4573	49 (27.22)	4409
>200	8 (13.33)	37.02	15 (25.00)	4565	4 (6.67)	4451	27 (15.00)	4292
Sample size	60 (100)	-	60 (100)	-	60 (100)	-	180 (100)	-

Figures in parentheses indicate the percentages of farmers

The results showed that the highest average productivity of 4568 kg per ha was obtained by 7.22 per cent of the sample farmers who had applied more than 90 kg per ha of phosphorus, against the recommended dosage of 62.5 kg per ha. It was found that a vast majority of the farmers (65.56 per cent) used phosphorus close to the recommended dosage and realised on an average 4321 kg of wheat per ha. The proportion of farmers applying lower levels (< 50 kg per ha) of this input was found to be about 8 per cent with relatively low average productivity of 3971 kg per ha. The zone-wise analysis showed that the proportion of low users of phosphorus nutrient was the highest in Zone-I, proportion of very high users was the highest in Zone-II.

It is important to note that irrespective of the agronomic recommendations with respect to the use of nitrogen and phosphorus, the highest average productivity was obtained by the farmers who applied these nutrients at relatively higher levels. As the economic optimum lies at a point lower than where yield is the highest, the agronomic recommendations taking care of this economic logic, is closer to the likely

economic recommendation. So, rather than finding the optimum level of fertilizer nutrients, it is more important to screen out the low users and high users.

Table 6: Wheat productivity in response to phosphorus use, Punjab, 2008-09

(Kg ha^{-1})

Dosage	Zone I		Zone II		Zone III		Overall	
	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield
<50	7	3938	2	3405	5	4243	14	3971
	(11.67)		(3.33)		(8.33)		(7.78)	
50-70	46	4029	23	4414	49	4552	118	4321
	(76.67)		(38.33)		(81.67)		(65.56)	
70-90	6	3899	24	4483	5	4857	35	4436
	(10.00)		(40.00)		(8.33)		(19.44)	
>90	1	4300	11	4621	1	4259	13	4568
	(1.67)		(18.33)		(1.67)		(7.22)	
Sample size	60		60		60		180	
	(100)		(100)		(100)		(100)	

Figures in parentheses indicate the percentages of farmers

Application of Insecticides and Weedicides

The adoption of high yielding varieties along with heavy doses of fertilizers and irrigation brought the problem of weeds and insect/diseases. Earlier, the manual weeding was common in wheat but due to increasing scarcity of labour and availability of effective weedicides, the farmers are now mainly relying on chemical weed control. Similarly, to save the crop from frequent insect pest and disease attacks the farmers' reliance on chemicals has increased in a major way. As these chemicals are available in different grades, rather than in physical terms their application levels needs to be revalidated on the basis of field data. The use of chemicals in monetary terms with comparative impact on wheat productivity is presented in Tables 7 and 8.

It may be observed from Table 7 that major proportion (35.56percent) of the farmers incurred expenditure on the weedicides in the range of ` 900 to ` 1100 per ha followed by another 24.44 per cent who spent in the range of ` 700 to ` 900 per ha. The highest average productivity of wheat was achieved by about 13 per cent farmers who spent on weedicide use between ` 500 and ` 700 per ha. However, there were 17.22 per cent farmers, who spent more than ` 1100 per ha and realised lower yield as compared to the farmers who expended lower amount on plant protection material.

The results did not show a clear relationship between the amount spent on weedicides and wheat productivity in the state, the reason may be that a range of different weedicides applied by the farmers to their wheat crop might have been

equally effective under varying soils. The time and method of weedicide application may be more important than the amount spent per hectare. Thus, wheat farmers in state can reduce their production cost by adopting timely as well as accurate method of weedicide application. The situation across the zones presented similar picture with respect to use of weedicides and productivity achieved with some exceptions in Zone-III.

Table 7: Wheat productivity in relation to weedicide use in Punjab, 2008-09

(Kg ha^{-1})

Expenses (` ha^{-1})	Zone I		Zone II		Zone III		Overall	
	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield
<300	-	-	-	-	10 (16.67)	4267	10 (5.56)	4267
300-500	2 (3.33)	3677	1 (1.67)	4333	5 (8.33)	4359	8 (4.44)	4185
500-700	5 (8.33)	4437	3 (5.00)	4343	15 (25.00)	4448	23 (12.78)	4432
700-900	16 (26.67)	4004	13 (21.67)	4535	15 (25.00)	4538	44 (24.44)	4343
900-1100	23 (38.33)	4001	29 (48.33)	4336	12 (20.00)	4789	64 (35.56)	4301
≥1100	14 (23.33)	3228	14 (23.33)	4622	3 (5.00)	4683	31 (17.22)	3998
Sample size	60 (100)	-	60 (100)	-	60 (100)	-	180 (100)	-

Figures in parentheses indicate the percentages of farmers

The study showed a positive relationship between the amount spent on insecticides and wheat productivity at overall State level as well as in different zones with some variations. The perusal of Table 8 indicates that there were about two thirds of the sample farmers who expended less than ` 300 per ha on this vital input and realised an average 4225 kg per ha of wheat productivity. This was considerably lower as compared to productivity at more than 4500 kg per ha achieved by about 14 per cent farmers who spent on insecticides more than ` 500 per ha. Thus, with ever increasing attacks of insect pests and diseases on wheat crop in Punjab, proper and timely application of chemicals may reduce the productivity losses significantly.

Table 8: Wheat productivity in relation to use of insecticide in Punjab, 2008-09

(Kg ha^{-1})

Expenses (` ha^{-1})	Zone I		Zone II		Zone III		Overall	
	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield	Farmers (No.)	Yield
<300	47 (78.33)	3907	41 (68.33)	4409	28 (46.67)	4491	116 (64.44)	4225
300-500	10 (16.67)	4284	12 (20.00)	4508	16 (26.67)	4513	38 (21.11)	4451
500-700	2 (3.33)	4689	5 (8.33)	4527	11 (18.33)	4632	18 (10.00)	4609
>700	1 (1.67)	4750	2 (3.33)	4626	5 (8.33)	4420	8 (4.44)	4513
Sample size	60 (100)	--	60 (100)	-	60 (100)	-	180 (100)	-

Figures in parentheses indicate the percentages of farmers

Production Function Analysis

Output of the farm resources per hectare for a particular crop on a farm firm is a function of the different inputs used. The production function analysis recognizes the basic functional relationship, thus, helps to arrive at some judgment about the efficiency of prevalent factor proportions in the optimal direction. The elasticity of wheat productivity with respect to use of important inputs was studied through fitting production functions and results are given in Table 9. The value of R^2revealed that the explanatory variables included in the model explained about 62 per cent variation in the magnitude of the dependent variable. The coefficients of irrigation, expenditure on plant protection chemicals and use of nitrogen were found to be positive and significant statistically.The magnitude of coefficients indicated that with one per cent increase in irrigation, expenditure on plant protection chemicals and use of nitrogen, the proportionate increase in wheat productivity would have been 0.23 per cent, 0.02 per cent and 0.09 per cent, respectively.

The negative significant coefficient of sowing time indicated negative relationship between wheat productivity and delay in the sowing of crop. Use of phosphorus turned out to be non-significant statistically showing that wheat productivity was not affected across different farm categories. Similarly, with large scale mechanization of various operations of wheat cultivation, the coefficient with respect to use of human labour also turned out to be non-significant statistically.

Table 9: Coefficients of production function (Log Linear) for wheat productivity in Punjab, 2008-09

Variables	Elasticity Coefficient	Standard Error
Constant	2.967***	0.241
Human Labour	-0.0125NS	0.009
Sowing Time	-0.056***	0.007
Irrigation	0.233***	0.023
Nitrogen	0.091**	0.454
Phosphorus	-0.003NS	0.004
Plant Protection	0.022***	0.012
R^2	0.62	-
Sample size	180	-

****** and ** Significant at 1 and 5 per cent level respectively***
NS: Non-significant

CONCLUSIONS

Wheat being the premier crop of Punjab state occupies around 85 percent of the total cropped area during the *rabi* season. The wheat productivity on sample farms ranged between 2017 and 6122 kg per ha with an overall average of 4434 kg per ha in Punjab. About 10 percent farmers obtained a productivity of less than 3000kg per ha and about 14 percent farmers had a productivity of more than 5000 kg per ha. Such differentials in productivity were studied with respect to the use of important inputs. The farmers sowing wheat crop up to the first week of November were found torealise the highest productivity. A significant decline in wheat productivity was observed for crop sown in subsequent weeks after second week of November. Irrigations up to six in number showed positive relationship with the wheat productivity. With respect to the use of fertilizer nutrients it was found that about 24 percent farmers used nitrogen as per the recommendations. However, the yield was found to be significantly higher for the farmers who had applied nitrogen in the range of 140-170 kg per ha. There were about 42 percent farmers who applied more than 170 kg of nitrogen without significant additions to the productivity, resulting in increased cost of production. About two third of farmers have applied phosphorus fertilizers close to the recommended level (62 kg per ha). Thehighest average productivity was obtained by farmers who used 90 kg per ha or above of phosphorus. The production function analysis revealed that sowing time, irrigation,

nitrogen application and expenditure on plant protection were the major determinants of wheat productivity in the state. Thus, the farmers need to be educated regarding the role of these inputs in increasing the productivity and decreasing the cost of wheat production.

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Indian J. Econ. Dev.
Volume 8 No. 2 (2012): 41-48

PHYSICAL AND FINANCIAL APPRAISAL OF MGNREGA IN HARYANA-A CASE OF HISAR DISTRICT

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ABSTRACT

The study was undertaken to examine the physical and financial performance of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) in Haryana. The results revealed that the number of household provided employment under MGNREGA has increased rapidly during the period 2008-12 respectively. The total funds available to the district administration and total expenditure incurred under have increased through time. Similarely, the percentage of expenditure to total funds available have shown an upward trend. The number of job cards issued to rural households (RHH) nearly tripled in 2011-12 over 2008-09. The results conclusively revealed that the number of job seekers under this scheme has been increasing all through the study period. The results have highlighted increasing participation of women in MGNREGA scheme. The income of the participating households working under scheme has been supplemented to large extent.

INTRODUCTION

The National Rural Employment Guarantee Act, 2005 popularly known as NREGA came into force from February, 2006. It was renamed as Mahatma Gandhi National Rural Employment Guarantee Act**(**MGNREGA**)**and aimed to ensure legal right to work for 100 days to a person belonging to poor rural households.The main objective of the programme is to create sustainable rural livelihood through re-generation of the natural resource-base by way of augmenting productivity, supporting the creation of durable assets, strengthing rural governance through decentralization and process of transparency and accountability. The MGNREGA is completely different in concept from earlier employment scheme since it treats employment as a right and is initiated to be demand driven (Sarkar *et. al*, 2011).

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One of the major planks of rapid poverty reduction in the Eleventh Five Year Plan is the successful implementation of MGNREGA in all states of India. This scheme is also an important strategy in the entire economic context. The fiscal policy that provides more income directly to unskilled workers in the rural areas is likely to be much more effective in increasing aggregate income than other forms of public spending (Shah *et al.*, 2010). In a country like India, where 70 per cent of population living in about 6.25 lakh villages and mainly depends upon agriculture, MGNREGA provided additional work and wages for rural households, agricultural labourers especially working in farms and housewives. Under this employment scheme, one household can work and earn wage up to 100 man days and there is no time bound attendance on worksite, which is a boon especially for rural women which may work on MGNREGA site when they are free from their other daily chores.

It provided advantages to the entire rural India in the shape of economic empowerment, improved standard of living, enhancement of awareness, increased social interaction, increased participation level in Gram Sabha meetings, decision making capacity in family and community. Under this scheme use of machinery which replaces human labor is minimized. Wage rate for both men and women are the same and one-third of beneficiaries should be women. It also provides equal opportunities to scheduled castes and tribes and other weaker section of society (Vanitha *et. al*, 2011).

Initially this scheme was implemented in 200 identified backward districts in the country spread over 27 states. In Haryana, MGNREGA was initially implemented in Mahendergarh and Sirsa districts. Later on the scheme was extended in all districts of the country in April 2008. The Gram Panchayat works as implementing agency and is involved in planning and monitoring of scheme at village level under supervision of District Administration. The job cards are issued to all rural households seeking employment and provision of unemployment allowance is also there if work is not assigned within 15 days of application. After implementation of the scheme many studies were conducted in different states on the performance appraisal of MGNREGA. In this background, the present study was under taken to examine the physical and financial performance of MGNREGA in Haryana by taking up district Hisar as a case study.

METHODOLOGY

Mahatma Gandhi National Rural Employment Guarantee Actwas implemented in three phases in the state of Haryana. Hisar was covered under the scheme in 3rd phase i.e. from 1st April 2008. Since implementation of the scheme district Hisar showed positive growth in all physical and financial aspects of the scheme from 2008-09 to 2011-12. In financial year 2011-12, total expenditure under the scheme in the Hisar was highest among all districts i.e. ₹ 6301 crore out of ₹ 21865 crore of the whole state. So the district Hisar was selected for the present study. The study was based on the secondary data were collected from published sources including journals, reports, manuals and instructions issued by Department of Rural Development of Haryana pertaining physical and financial progress of the scheme. The data so collected were tabulated and analyzed by using simple statistical techniques like average, percentage, ratio, etc. The performance indicators such as the total funds available, total expenditure and distribution of expenditure have been used to examine the financial performance of MGNREGA. The physical performance was judged by examining the performance indicators such as employment provided, employment generated and its structural composition.

RESULTS AND DISCUSSION

The results obtained from the analysis of data are discussed under two broad sub-heads namely financial and physical performance of MGNREGA as under:

Financial Performance of MGNREGA

The total funds available to the district administration, total expenditure, total works taken up and works completed works ongoing under MGNREGA in Hisar district has been presented in Table 1and results are discussed as under.

Percentage of expenditure to total available fund and work status

The data presented in Table 1 showed that total fund available to the district administration was ₹ 638 lakh in 2008-09 which increased to₹ 6419 lakh in 2011-12. The respective figures for expenditure incurred on various aspects under this scheme were ₹ 343 lakh and ₹ 6279 lakh in the above said yearsrespectively.

The percentage of expenditure to total available funds was estimated to be 51.76, 57.93, 81.06 and 97.81 from 2008-09 through 2011-12 respectively. The total number of works taken up has increased from 179 to 3657 during the period 2008-12.The results showed that the works completed came out to be 54, 222, 709 and

2379 during period 2008-09 through 2011-12 respectively. The number of works completed and percentage to total works taken up showed an increasing trend all over the period except financial year 2010-11. This clearly indicated that utilization of funds and work taken up and completed under MGNREGA has improved over time.

Table 1: Total funds and expenditure under MGNREGA in Hisar district

(₹ lakh)

Particulars	2008-09	2009-10	2010-11	2011-12
Total available funds	638	1827	3850	6419
Total expenditure	343	1055	3121	6279
	(51.76)	(57.74)	(81.06)	(97.81)
Total works taken up (No.)	179	443	1561	3657
Works completed(No.)	54	222	709	2379
	(30.16)	(50.11)	(45.41)	(65.05)
Works in Progress (No.)	123	221	852	1278
	(69.84)_	(49.89)	(54.59)	(34.95)

Figures in parentheses are percentage to the total.

Distribution of Expenditure in Labour

The percentage of expenditure on the services unskilled, semi-skilled and skilled workers, expenditure on materials and contingency, expenditure on administrative funds has been presented in Table 2. The results revealed that expenditure on un-skilled labor was ₹ 315 lakhs in 2008-09 which has increased to ₹ 3661 lakhs in 2011-12. The corresponding figures for unskilled labour were 91.83 and 58.17 per cent in the above said years.

The data given in Table 2 revealed that not a single penny was expended on semi-skilled and skilled labor during 2008-09 to 2009-10. The amount spent on hiring the services of semi-skilled and skilled laborwere came out to be ₹ 60 lakhs and ₹ 229 lakhsin 2010-11 and 2011-12 respectively. This constituted 1.97 and 3.63 per cent of total expenditure. It shows expenditure on to provide gainful employment to the semi-skilled and skilled labour has increased through time.

Expenditure on Material and Contingency

The data presented in Table 2 revealed that expenditure on materials and contingency was ₹17 lakhs in 2008-09 which increased to₹374 lakhs, ₹979 lakh and ₹ 2206 lakh in 2009-10, 2010-11 and 2011-12 respectively.The percentage of expenditure on material and contingency was estimated to be 4.95, 35.45, 32.06 and

35.13 of the total expenditure in the above said years respectively. This was lower than stipulated 40 per cent expenditure of the total funds allocated under this headas per guidelines of the MGNREGA.

Table 2: Distribution of expenditure under MGNREGA in Hisar district

(₹ lakh)

Distribution of expenditure	2008-09	2009-10	2010-11	2011-12
Total expenditure	343	1055	3054	6279
Expenditure on un-skilled wages	315 (91.83)	641 (60.75)	1990 (65.17)	3661 (58.30)
Expenditure on semi-skilled and skilled wages	0 (0.00)	0 (0.00)	60 (1.97)	229 (3.41)
Expenditure on material and contingency	17 (4.95)	374 (35.45)	979 (32.06)	2206 (35.13)
Expenditure on administrative Funds	11 (3.20)	40 (3.65)	25 (0.81)	197 (3.15)
Ratio of wages cost to material cost	92:8	61:39	67:33	62:38

Figures in parentheses are percentage to the total.

Expenditure on Administration

The data presented in Table 2 clearly shows that along with progress of the scheme, administrative expenditure has increased during the study period. As such expenditure on above said was ₹ 11 lakhs in 2008-09 which increased to ₹197 lakhs in 2011-12. The percentage of expenditure on administration was 3.20 and 3.15 in the above said years which was lower than stipulated one (6.00 per cent) as per guidelines of MGNREGA. This calls for an attention of the concerned authority so as to meet the guidelines of MGNREGA.

Percentage of Wage Cost to Material Cost

The ratio of wage cost to material cost has been calculated by dividing the expenditure on unskilled, semi-skilled and skilled workers to expenditure on material cost. The ratio of wages and material cost was estimated to be 92:8, 61:39, 67:33 and 62:38 during the period under study which is in the ratio of 60:40 as stipulated in the MGNREGA. Since expenditure was higher on wage cost and lower on material cost, so there may be possibilities of creation of more durable assets under the scheme. The employment generated under MGNREGA exhibited an increasing trend in the period under study (Table 2).

Physical Performance of MGNREGA

The physical performance of MGNREGA was judged on the basis of total number of job cards issued to rural household (RHH), number of RHH demanded employment, number of RHH provided employment, number of RHH completed 100 days of employment for the financial year from 2008-09 to 2011-12**.**

Job cards issued to the RHH

The data presented in Table 3 showed that the number of job cards issued to the RHH were 20979 in 2008-09 which increased to 59945 in 2011-12. A continuous increase in the absolute and percentage of RHH enrolled clearly shows that interest of rural folk is increasing day by day to seek employment under MGNREGA.

RHH demanded employment to the job cards issued

It is clearly evident from Table 3 that the number of RHH who demanded employment was 7436, 12482, 29826 and 45429 in the above said years respectively. The percentage of RHH that demanded employment and employment provided to the job cards holder issued was 35.44, 32.22, 71.11 and 75.78 in 2008-09, 2009-10, 2010-11 and 2011-12 respectively which shows employment under the scheme is picking up with time.

Performance in providing employment under MGNREGA

It was noticed that there was an increase in the number of RHH completed 100 days of employment points out that job card holder of rural people have taken interest of work at the minimum wage rate and number of such people willing to work under the scheme so that they may earn extra income is increasing overtime. The percent of such job card holders has increased from 2.60 in 2008-09 to 7.28 in 2011-12 (Table 3).

Table 3: Performance in providing employment under MGNREGA

Employment detailed under	2008-09	2009-10	2010-11	2011-12
Total job cards issued	20979	38735	41939	59945
Number of RHH demanded employment	7436 (35.44)	12482 (32.22)	29826 (71.11)	45429 (75.78)
Number of RHH provided employment	7436 (35.44)	12482 (32.22)	29826 (71.11)	45429 (75.78)
Cumulative No. of RHH which have completed 100 days of employment	194 (2.60)	463 (3.70)	1568 (5.25)	3309 (7.28)

Figures in parentheses are percentages to the total.

Employment Generated and its Structural Composition

The results presented in Table 4 revealed that the total employment generated under MGNREGA was 2.26 lakh person days in 2008-09 which increased to 20.26 lakh person days in 2011-12.It clearly indicates that the total employment generated under MGNREGA has increased over the years. The results further showed that total employment provided to schedule castes has increased from 1.87 lakh person days in 2008-09 which increased to 14.06 lakh person days in 2011-12. In the percentage terms employment provided to schedule castes has shown decreasing trend over the years. It was due to the increasing number of women and other caste seeking employment under MGNREGA.

Table 4: Employment generated and its structural composition in Haryana

(Lakh person days)

Year	Total employment generated	Scheduled Castes	Others	Women
2008-09	2.26	1.87	0.39	0.78
		(82.74)	(17.26)	(34.51)
2009-10	4.29	3.42	0.87	1.68
		(79.72)	(20.28)	(39.16)
2010-11	11.52	8.56	2.96	4.29
		(74.30)	(25.70)	(37.23)
2011-12	20.26	14.06	6.20	8.10
		(69.39)	(30.60)	(39.98)

Figures in the parentheses are percentage to the total.

The total employment provided to other caste was 0.39 in 2008-09 which increased by more than 15 times in 2011-12. The percentage of employment provided to other castes was estimated to be 17.26, 20.28, 25.70 and 30.60 in the years under study respectively. The employment provided to other castes was found to be increasing which shows that involvement of other castes in this employment scheme will help to improve their economic condition too. It was noticed that peoples were found to taking benefits from the scheme when they have no activities to perform. The Farm laborers are also earning the extra wages from the scheme in off-season period.

Employment provided to Women

The perusal of Table 4 revealed that the total employment provided to women was 0.78lakh person days in 2008-09 which increased by more than 10 times in 2011-12. The percentage of employment provided to women was found to be

increasing through time which was 34.51 in 2008-09 and 39.98 in 2011-12. The employment provided to women is almost more than the guidelines (33 percent) given in MGNREGA. This indicates that scheme has been proved boon for the women in rural area of Haryana. This scheme not only provides gainful employment but also helps them to become economically self dependent which ultimately empowers them in decision making.

CONCLUSIONS

The results revealed that the number of household provided employment under MGNREGA has increased rapidly during the period 2008-12 in Hisar District. The total funds available to the district administration was ₹ 638, ₹ 1827, ₹ 3850, and ₹6419 lakh in financial year 2008-09 to 2011-12 in Hisar district respectively. The total expenditure incurred under this scheme was ₹ 343, ₹1055, ₹3121 and ₹6293 lakh in the above said years respectively. The percentage of expenditure to total funds available was 51.76, 57.93, 81.06 and 98.03 during the years respectively. The number of job cards issued to rural households (RHH) nearly tripled from 20979 in 2008-09 to 59945 in 2011-12. The expenditure on material and administration was lower than the stipulated as per the guidelines of MGNREGA. The results conclusively revealed that the number of job seekers under this scheme has been increasing all through the study period. The results have highlighted increasing trend in the participation of women. All these indicate that substantial income is being provided to the household working under scheme.

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Indian J. Econ. Dev.
Volume 8 No. 2 (2012): 49-62

DETERMINANTS OF TOTAL FACTOR PRODUCTIVITY GROWTH FOR MAJOR AGRICULTURAL CROPS IN PUNJAB

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ABSTRACT

The present study was undertaken to analyse the growth pattern of production, productivity and to trace the determinants of total factor productivity (TFP) growth of important crops in Punjab. The productivity of wheat rose from 1.1 to 1.6 tonne per hectare during 1960-61 to 2007-08 in Punjab. The corresponding figures for paddy were 1.6 and 6.0 tonne per hectare in above said years, respectively. But since nineties, Punjab agriculture is facing the problem of stagnation of productivity which was found to be more acute in wheat crop as compared to rice. For paddy, wheat and cotton, the TFP index showed high rate of increase in average annual growth inPeriod-II (1990-91 to 2004-05) as compared to Period-I (1981-82 to 1989-90). The results of decomposition of TFP confirm that market infrastructure, rainfall during June to August, the agricultural terms of trade and investment on research and development (R&D) were the most important factors of growth in TFP. The predominance of paddy-wheat monoculture in the state is posing a serious threat to soil health and disturbing underground water, along with ecological balances in the state and almost stagnant yields. To overcome these constraints, the study highlighted the need for evolution of high yielding variety of crops, integrated use of balanced chemical fertilizers in conjunction with organic manures (compost and green manure), to promote integrated pest management and to increase the investment on research and development.

INTRODUCTION

The Punjab agriculture has registered spectacular progress since the country became independent in 1947. Consequently, the foodgrain production in the state increased from 3 million tonnes in 1961 to 25.6 million tonnes in 2009-10 which accounted for about 13 per cent of total foodgrains production with only 1.75 per cent of total geographical area in the country. An effective price policy coupled with relatively better technology available, has resulted into the emergence of paddy and

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wheat crops as the most secure and profitable ones in the state. The productivity of paddy and wheat has recorded a growth of 4.33 and 3.30 per cent per annum for the period of 1965-66 to 1989-90. But still the yield rates of the major crops in the state are quite higher as compared to the national average. This became possible by taking a big leap forward in terms of irrigation facilities, use of chemical fertilizer, pesticide, high yielding varieties seed, mechanization, etc. in Punjab.

The transformation of Punjab agriculture has started showing signs of new set of problems since the nineties. The productivity of major crops like wheat and rice has stagnated leading to increase in cost of production resulting in reduced profitability making many small and marginal farmers economically unviable. The impact of technology has slowed down mainly because of soil fatigue resulting in decline in fertilizers use efficiency in the recent past. The predominance of paddy-wheat monoculture is posing a great threat to soil health, resulting in depletion of underground water.

The growth in total factor productivity (TFP) or technical change in agriculture is both a necessary and sufficient condition for its development. It is a necessary condition because it enables agriculture to avoid a trap into Ricardo's Law of Diminishing Returns to which the sector is more prone. It is a sufficient condition because it increases production at reduced unit-costs/prices in real terms (Kahlon and Tyagi, 1983; Kumar and Mruthyunjaya, 1992; Rao, 1994; Kumar and Rosegrant, 1994; Singh *et al.*, 1995 and Acharya, 1997). The past literature shows that technical change in agriculture is determined by non-price factors like government expenditure on research and development (R&D) and infrastructure. But more recent literature also considers relative farm prices that would provide incentives for technical change. This has been reinforced by the present policy in the wake of reforms that reduce protection to trade and industry for advocating its prime role for technical change. Among the non-price factors it separately considers government investment in R&D, inputs, credit, rural literacy and marketing and banking infrastructure density in addition to land reforms. The earlier studies show that technical change is influenced by non-price factors like government investment in agricultural research, education, extension, and infrastructure like rural roads, regulated markets, etc. (Rosegrant and Evenson, 1994 and Kumar and Rosegrant, 1994). It must be stated that among the three agricultural strategy options of extensive farming, intensive agriculture, and technical change, it is technical change which is universally accepted as the best strategy (Desai, 1997).

The TFP postulates increases in total output less increases in total (all) inputs (Dension, 1962 and Hayami*et al.*, 1979). This implies an upward/downward shift in production/ cost function and hence it represents efficiency growth. The technical change so defined is studied in earlier literature that has three heroic assumptions. Firstly, it assumed perfectly competitive product and factor markets, secondly, it considered technical change to be Hicks- neutral, that is, relative payments to factors of production are unbiased and thirdly, technical change is disembodied (Evenson and Yoav, 1975; Dholakia and Dholakia, 1993). More recent literature, however, does not make any of these restrictive assumptions (Kumar and Mruthyunjaya, 1992; Kumar and Rosegrant 1994 and Rosegrant and Evenson, 1994). Underlying the approach in this literature that follows Christensen (1975) and Diewert (1976), is a translog production function. This production function allows for non-constant as well as constant retums to the scale, complementarity so unique to agricultural production process and operation of imperfect markets. Diewert (1976) derived Tornqvist-Theil Index of TFP from the translog production function. This index is computed as the ratio of an index of aggregate output to an index of aggregate inputs. Earlier studies which used index-based method include study on wheat (Kumar and Mruthyunjaya, 1992), rice (Kumar and Rosegrant, 1994) and major crops-sector as a whole (Rosegrant and Evenson, 1994).

In the back drop of this, the present study was carried out to examine the growth pattern of production and productivity of important crops and to trace the determinants for total factor productivity growth of important crops in Punjab.

METHODOLOGY

This paper is part of the larger study entitled *Determinants in Stagnation of Productivity of Important Crops in Punjab*completed by AERC, Ludhiana and funded by Ministry of Agriculture, New Delhi (Kumar and Singh, 2010). The present paper was based on the secondary data related to area, production, productivity of various crops in Punjab and major growth parameters collected from the various sources such as *Centre for Monitoring Indian Economy, Statistical Abstracts of Punjab, Agricultural Statistics at a Glance* and Directorate of Agriculture, Punjab. To ascertain the temporal growth in area, production and productivity of different crops in the state, the horizon was divided to four periods viz. Period-I (1960-61 to

1966-67); Period-II (1967-68 to 1979-80); Period-III (1980-81 to 1989-90) and Period-IV (1990-91 to 2006-07).

In order to measure the TFP of paddy, wheat and cotton, the farm level data relating to input costs (`/ha) like human labour, machine labour, bullock labour, fertilizers and manures, insecticides, irrigation charges, etc., and returns of cotton crop for the period of 1981-82 to 2004-05 were collected from the reports of Commission for Agricultural Costs and Prices (CACP) published by Ministry of Agriculture, New Delhi and *Comprehensive Scheme to Study the Cost of Cultivation of Principal Crops in Punjab* running in the Department of Economics and sociology, Punjab Agricultural University Ludhiana.

Total output, total inputs and TFP indices were calculated by using Tornqvist-Theil Index as follow:

$$\Delta TFP = \ln\left(\frac{TFP_t}{TFP_{t-1}}\right) = \ln\left(\frac{Ql_t}{Ql_{t-1}}\right) - \ln\left(\frac{Xl_t}{Xl_{t-1}}\right) = \sum\frac{1}{2}(R_{it} + R_{it-1})\ln\left(\frac{Q_{it}}{Q_{it-1}}\right) - \sum\frac{1}{2}(S_{jt} + S_{jt-1})\ln\left(\frac{X_{jt}}{X_{jt-1}}\right)$$

Where,

Δ TFP = Growth in total factor productivity,
Ql_t = Output index,
Xl_t = Input index,
Q_{it} = Output i,
X_{jt} = Input j,
R_{it} = Revenue share of output i and
S_{jt} = Cost share of input j
t = Time period.

In order to assess the determinants of TFP, the TFP index was estimated as a function of the independent variables like June to August rainfall, annual rainfall, agricultural terms of trade, investment on research and development (R&D) per hectare, literacy (the proportion of rural population who are literate) and the number of regulated markets per thousand hectare of cropped area. The development of rural infrastructure in India (such as roads, communications, institutional support and provision of storage and warehousing) are closely associated with the establishment of regulated markets, so the latter variable is used as a proxy for the level of infrastructure development. As most of the independent variables are sector specific (crop-wise data for independent variables was not available) and therefore weighted TFP index for the state as a whole was constructed (by taking crop-wise area share as weights) and then factors affecting TFP was analysed. Dependent variable is the log

of TFP index. All variables were specified in logarithms, except the literacy, which was entered linearly.

RESULTS AND DISCUSSION

The results obtained from the analysis of data are discussed under sub-head as under:

Area, Production and Productivity Growth

The temporal changes in the area, production and productivity of different crops in the Punjab state has been presented in Table 1. There was tremendous increase in area, production and yield of paddy for all the periods under study. Wheat also showed the same trend but the increase was lower than for the paddy. Increase in area and productivity of these crops are the main movers for the increase in production of these crops in the state. All other crops showed either decrease or a negligible increase in area during the period under study. Consequently, the paddy and wheat crop rotation became predominant at the cost of maize, other cereals, oilseed and pulses. A cursory glance on the Table 1 revealed that the productivity of paddy and wheat was consistently improving over the years but the growth has slowed down in Period-III, particularly during nineties. The productivity of rice increased at the significant rate of 6.95 per cent per annum during Period-II and afterwards it reached plateau during the Period-III and did not show any significant growth. Recently, the productivity of wheat also showed the signs of stagnation and the decline in the wheat yield was more pronounced as compared to paddy. It shows that the genetic potential of wheat was exploited till 1980s and then got stabilized while the process has been continuing but the rate of growth has slowed down in the case of paddy crop. The monoculture of paddy and wheat has also caused resurgence of pest and diseases and weeds, which have adversely affected the crop yield. Cotton (American) showed significant increase in area during the Period-II and III and replaced the area under local cotton varieties. But due to the persistent attack of insect pest on the cotton (American) crop, its area and production was badly hit during nineties. The productivity of sugarcane and potato has also stagnated during the recent years. On the other hand, there was a notable growth in productivity of maize in spite of this the area under this crop declined at a significant rate.

Table 1: Compound annual growth rates of area (A), production (P) and yield (Y) of major crops in differentperiods in Punjab

(Per cent per annum)

Year	1960-61 to 1966-67			1967-68 to 1979-80			1980-81 to 1989-90			1990-91 to 2006-07		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Rice	4.86***	7.18***	2.20 NS	11.17***	18.90***	6.95***	5.34***	6.70***	1.30 NS	1.86***	2.95***	1.07***
	(0.75)	(1.76)	(1.40)	(0.78)	(0.79)	(0.70)	(0.62)	(1.23)	(0.78)	(1.86)	(0.23)	(0.22)
Bajra	6.83**	10.57 NS	3.97 NS	-8.54***	-9.04***	-0.55 NS	-18.63***	-21.34***	-3.07**	-3.45**	-4.61***	-0.98 NS
	(3.93)	(6.66)	(4.67)	(1.80)	(1.94)	(0.80)	(2.31)	(2.21)	(1.24)	(1.26)	(1.48)	(0.60)
Maize	23.60NS	10.14*	5.11 NS	-1.47 NS	-1.38 NS	-0.08 NS	-5.64***	-6.83***	-1.27 NS	-1.42***	1.68**	3.13***
	(20.51)	(3.65)	(3.82)	(0.82)	(0.85)	(0.83)	(0.55)	(1.49)	(1.74)	(0.19)	(0.65)	(0.57)
Wheat	2.20***	5.44**	3.17 NS	2.95***	5.42***	2.40***	1.25***	4.29***	3.0***	0.45***	1.31***	0.29 NS
	(0.35)	(1.89)	(1.74)	(0.40)	(0.70)	(0.37)	(0.25)	(0.67)	(0.65)	(0.07)	(0.29)	(2.72)
Barley	4.54 NS	8.59**	3.76 NS	-4.98 NS	-1.26 NS	3.87***	-7.92***	-2.99	5.55***	-5.32***	-4.0****	1.38***
	(4.27)	(3.68)	(3.43)	(3.35)	(3.32)	(0.87)	(1.71)	(2.50)	(1.38)	(0.52)	(0.68)	(0.28)
Gram	-5.64***	-6.95 NS	-1.39 NS	-2.86**	-3.27 NS	0.12 NS	14.15***	-10.20**	4.52 NS	-13.61***	-12.30***	1.46***
	(1.07)	(3.58)	(3.22)	(1.19)	(1.83)	(0.95)	(2.15)	(3.83)	(2.84)	(0.90)	(0.94)	(0.48)
Rapeseed & mustard	-0.52 NS	0.34 NS	0.87 NS	0.90 NS	2.06 NS	3.19**	-0.04 NS	5.51 NS	5.49***	-3.78***	-3.37***	0.41 NS
	(2.70)	(1.27)	(3.02)	(2.58)	(3.08)	(1.25)	(2.57)	(3.59)	(1.66)	(0.83)	(0.93)	(0.55)
Sunflower	-	-	-	-	-	-	-	-	-	-1.39 NS	-1.16NS	0.07 NS
										(4.75)	(4.84)	(0.56)
Sesamum	7.85 NS	9.61*	1.64 NS	0.73 NS	0.70 NS	-0.03 NS	-1.85 NS	-1.20 NS	0.67 NS	-4.01***	-4.23***	-0.22 NS
	(5.94)	(4.79)	(3.65)	(2.27)	(2.16)	(0.74)	(2.12)	(1.73)	(1.59)	(0.88)	(1.01)	(0.57)
Sugarcane	3.91 NS	2.50 NS	-1.32 NS	-3.41***	0.77 NS	4.31***	2.07 NS	2.71	0.64 NS	0.15 NS	-0.13 NS	0.29 NS
	(2.87)	(3.47)	(1.99)	(0.92)	(1.30)	(0.65)	(1.59)	(1.56)	(0.70)	(1.18)	(1.21)	(0.25)
Dry chillies	-	-	-	-0.98	-1.18 NS	-0.20 NS	-14.48***	-9.47***	2.28 NS	-3.73**	-3.12**	0.64***
				(2.72)	(2.59)	(0.79)	(2.03)	(2.22)	(0.93)	(1.39)	(1.44)	(0.20)
Potato	9.46***	10.57**	0.95 NS	10.31***	15.00***	4.32***	-2.37***	-2.47	0.29 NS	8.07****	8.02***	-0.19 NS
	(2.51)	(3.87)	(2.34)	(1.29)	(1.90)	(0.84)	(1.62)	(1.65)	(2.59)	(1.24)	(1.33)	(0.46)
Cotton A	-1.23 NS	1.80 NS	3.04***	7.67***	8.17***	-0.12 NS	2.44 NS	11.28***	8.61**	-2.32**	-0.85 NS	1.51 NS
	(2.01)	(2.51)	(0.90)	(0.77)	(0.76)	(0.42)	(1.70)	(2.81)	(1.85)	(0.86)	(2.39)	(2.03)
Cotton D	0.38 NS	0.01 NS	-0.36 NS	-0.94 NS	-2.35 NS	-1.96***	-10.83***	-5.72 NS	5.71 NS	-2.10 NS	1.18 NS	3.32*
	(1.96)	(2.33)	(0.51)	(1.15)	(1.53)	(0.46)	(1.85)	(3.16)	(2.91)	(1.84)	(1.72)	(1.25)

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

NS: Non-significant

Figures in the parentheses are Standard errors

Changes in Inputs Use

The Punjab state has taken a big leap forward in terms of chemical fertilizer use, high yielding varieties (HYVs), mechanization, etc., which resulted into development phenomenon popularly known as Green Revolution. Presently, entire area allocated to rice, wheat and bajra is covered by the high yielding variety seeds. The area under HYVs increased from about 22 lakh hectares during 1971-75 to about 61 lakh hectares during 2001-05 (Table 2). The total availability of agricultural credit has increased from ` 945 million to ` 88838 million during the above said period. Till mid-1960s, primary agricultural cooperative societies were the only formal agency for the disbursal of rural credit. Thus, the availability of credit was augmented through Land Development Banks (LDB) and later through commercial and regional rural banks.

Table 2: Major inputs use in Punjab, 1971-75 thruogh 2001-05

Year	GCA under HYVs (000' ha)	Agriculture Credit (` lakhs)	Tractor (Number)	Pump set (Number)		Fertiliser consumption (NPK)	
				Electrical	Diesel	Kg ha^{-1}	Nutrients 000' tonnes
1971-75	2232.60	9451.12	39469	120600	182600	47.03	275.80
1976-80	3375.60	23798.33	82400	234400	343400	75.04	484.40
1981-85	4450.60	76278.70	143100	384600	281200	130.09	901.20
1986-90	4995.20	124328.39	226600	548000	211600	153.18	1117.60
1991-95	5432.40	205677.15	293000	648200	190000	162.72	1233.00
1996-00	5691.60	394593.03	375951	732000	173000	168.74	1321.40
2001-05	6120.80	888386.07	450691	827000	242400	183.96	1452.80

Source: Statistical Abstracts of Punjab and the Director of Agriculture, Punjab

The total consumption of NPK in Punjab was merely 276 thousand tonnes of nutrient during 1971-75, has continuously increased over time and reached to a level of 14.52 lakh tonnes of nutrient by the period 2001-05. The consumption of chemical fertilizer per hectare was the highest in Punjab in the country. The use of fertilizer was about 184 kg per hectare during the period 2001-05 as compared to average of 47 kg per hectare during 1971-75. The rapid adoption of green revolution technology due to increased farm income has led to a sharp increase in farm mechanization in Punjab. As such the density of tractors has increased from 5 in 1960-61 to 64 per thousand hectares in the recent years in Punjab, which is the highest in India. Similarly, electric tube wells are increasing rapidly in Punjab and it has crossed the figure of 8.27 lakh by 2001-05. It was due to the state policy to supply free electricity

for the irrigation purposes to the farm sector in Punjab. The number of diesel operated tube-wells which are used a supplementary source of irrigation is also increasing but at lower pace than the electricity operated tube-wells as such the number of diesel operated tube-wells was 2.42 lakhs in 2001-05.

Capital Formation in Agriculture

The proportion of gross capital formation in Punjab agriculture at current prices to the gross capital formation showed a decline from 21.7 per cent in 1980-81 to around 11 percent till 2003-04 but then decreased up to 9.8 per cent by the year 2005-06 (Table 3). The growth of capital formation in public sector was lower as compared to the private sector since 1980s. The capital formation in public sector at current prices increased from ` 42 crores in 1980-81 to about ` 198 crores in 2005-06, while the growth in private sector during the period was from ` 108 crores to about `1797 crores. Therefore, the private sector contributes more as compared to the public sector in the capital formation in Punjab agriculture.

Table 3: Trends in capital formation in agriculture (CFA) and its share in total gross capital formation (GCF) of Punjab

(`crores)

Year	Public	Private	Total	CFA as per cent to total GCF
1980-81	42.00	108.00	150.00	21.74
1995-96	415.19	1031.26	1446.45	11.65
2000-01	303.29	1305.99	1609.28	11.91
2003-04	72.80	1566.33	1639.13	11.30
2004-05	142.73	1665.07	1807.80	9.22
2005-06	197.82	1797.32	1995.17	9.86

Source: Statistical Abstracts of Punjab, Various issues

A look at the trends in expenditure on agricultre indicates different picture in the state during this period (Table 4). It exhibits stagnant real expenditure on agriculture at constant prices. Another dismal feature of the expenditure was that the exenditure on capital account was negative during some of the years under study. The total expenditure on agriculture, which was ` 14.55 crore during 1981-85, declined to ` 9.44 crore during 1996-00 and and then rose to ` 55.67 crore during the period 2001-05. Similarly, the expenditure at 1980-81 prices declined from ` 13.58 crore to Rs 1.93 crore and further increased to ` 9.69 crores in above said periods

respectively. Such trends undermines the extension delivery system of the state department meant for the dissemination of latest technologies. The decline in expenditure on agriculture sector, therefore, has severe implications for the growth of Punjab agriculture. A further look at the per hectare budgetary expenditure on agriculture in Punjab establishes the static trends during the period of study. No doubt, the expenditure on agriculture on current prices more than quadrupled from 1981-85 to 2001-05, there was a decrease in such expenditure at the constant prices.

The proportion of agriculture in the budgetary allocations has also declined significantly over time. At current prices, it declined continuously from 11.86 per cent during 1981-85 to 0.69 per cent during 1996-00 and then jumped to 2.41 per cent during 2001-05. While at constant prices, it declined continuously from 13.91 per cent during to 2.75 per cent during 1996-00 and then jumped to 11.85 per cent during the latter period. Hence, it appears that the agriculture sector has been totally neglected in the planned development efforts of the Government of Punjab despite the fact that around 31 percent of state GDP comes from agriculture.

Table 4: Public investments in agriculture for Punjab

Year	Capital Expenditure on Agricultural & allied heads (` crore year^{-1})		Capital Expenditure per hectare of net sown area (` year^{-1})		Share of Budget expenditure on agriculture	
	At current prices	At 1980-81 prices	At current prices	At 1980-81 prices	At current prices	At 1980-81 prices
1978-80	-13.70	-18.14	-33.0	-43.0	NA	NA
1981-85	14.55	13.58	35.0	32.0	11.86	13.91
1986-90	-7.39	-3.0	-18.0	-7.0	NA	NA
1991-95	28.76	8.90	68.0	21.0	3.30	8.52
1996-00	9.44	1.93	22.0	5.0	0.69	2.75
2001-05	55.67	9.69	151.0	26.0	2.41	11.85

Source: Statistical Abstract of Punjab, Various issues
NA: Not available

Total Factor Productivity for Major Agricultural Crops

The term TFP is an attempt to measure the amount of increase in the total output, which is not accounted for by increase in total inputs. There is a large residual, measured by total factor productivity, which is the contribution of improvement of technology/knowledge, infrastructural developments, human capital improvement and policy interventions. The TFP in paddy, wheat and cotton was

computed for the Period I (1981-82 to 1989-90) and Period II (1990-91 to 2004-05), which are presented in Table 5.

Table 5: Total input, total output and total factor productivity indices and their ACGR rates for important crops in Punjab, 1981-82 to 2004-05

Period	Paddy			Wheat			Cotton		
	TII	TOI	TFPI	TII	TOI	TFPI	TII	TOI	TFPI
Period I (1981-82 to 1989-90)									
1981-82	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1982-83	1.09	1.05	0.96	1.02	0.98	0.97	1.04	0.81	0.78
1983-84	1.11	1.05	0.94	1.07	1.20	1.13	1.15	1.96	1.71
1984-85	1.02	1.09	1.07	1.04	1.33	1.28	1.12	1.87	1.67
1985-86	1.03	1.24	1.21	1.04	1.12	1.07	1.16	1.83	1.58
1986-87	1.03	1.35	1.31	1.02	1.44	1.41	1.18	3.57	3.01
1987-88	0.98	1.35	1.38	1.01	1.62	1.60	1.03	0.31	0.30
1988-89	0.95	1.49	1.56	0.99	1.75	1.76	1.10	2.22	2.01
1989-90	0.93	1.59	1.71	1.02	1.85	1.82	1.11	1.81	1.63
CGR (%)	-0.77	6.55	7.89	0.22	9.44	9.11	1.22	9.00	7.00
Period II (1990-91 to 2004-05)									
1990-91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1991-92	0.95	1.27	1.35	1.24	1.16	0.94	0.90	0.72	0.79
1992-93	1.01	1.49	1.48	1.01	1.42	1.40	0.85	0.82	0.96
1993-94	0.97	1.47	1.51	0.99	1.32	1.34	0.87	1.27	1.45
1994-95	0.91	1.38	1.52	0.99	1.27	1.29	0.91	0.92	1.02
1995-96	0.95	1.64	1.73	1.03	1.90	1.85	0.95	0.90	0.94
1996-97	0.89	1.85	2.08	1.00	1.72	1.72	0.78	0.46	0.59
1997-98	0.90	1.70	1.89	0.97	2.16	2.24	0.79	0.49	0.63
1998-99	0.89	2.19	2.47	0.96	2.51	2.62	0.85	0.82	0.96
1999-00	0.88	2.34	2.67	0.94	2.55	2.72	0.84	1.15	1.36
2000-01	0.89	2.62	2.96	0.92	2.50	2.74	0.84	0.90	1.07
2001-02	0.97	2.61	2.70	0.89	2.35	2.62	0.87	1.17	1.35
2002-03	0.91	3.01	3.31	0.86	2.25	2.62	0.89	1.90	2.14
2003-04	0.92	3.29	3.58	0.85	2.49	2.92	0.88	2.02	2.29
2004-05	0.90	2.90	3.23	0.90	2.70	3.00	0.77	1.97	2.57
CGR (%)	-0.66	12.67	14.87	-0.67	11.33	13.33	-1.53	6.47	10.47

TII: Total input index, TOI: Total output index and TFPI: Total factor productivity index

TFP of paddy

The results presented in Table 5 revealed that the total input index of paddy first increased to 1.11 till 1983-84; then decreased to 1.02 in 1984-85 and remained almost stable for the next two years and decreased constantly afterwards till it reached 0.93 by the year 1989-90 in Period-I. As far as, the total output index of

paddy was concerned, there has been constant increase and the value touched as high as 1.59 in 1989-90. The TFP index was found to be less than one during the periods 1982-83 and 1983-84 and for rest of the periods, it was more than one, which indicates the higher returns of paddy cultivation. The results for Period-II revealed that the total input index of paddy in Punjab has been more than one in the year 1992-93 only, otherwise it was less than one for the other years. The total output index as well as TFP index of paddy has been increasing almost constantly in Period-II and the values touched the highest level in year 2003-04, which shows that the returns from paddy are increasing continuously.

TFP of wheat

For wheat, the results for Period-I revealed that the total input index was revolving around one and was just more than one for most of the year except in 1988-89. The total output index and TFP index were showing almost the same pattern of continuous increase over the period showing that the output and productivity were continuously increasing during the period under study. The results for Period II revealed that the total input index of wheat has been more than one in 1991-92 and 1992-93, otherwise it was less than or equal to one for the other years. As in Period I, the total output index and TFP index were showing almost the same pattern of continuous increase over the Period II showing that the output and productivity were continuously increasing during the period (Table 5).

TFP of cotton

The total input index of cotton has been increasing constantly during the period 1981-82 to 1986-87 and then declined to 1.03 in 1987-88 and again risen to 1.11 in 1989-90. As far as the total output and TFP indices of cotton were concerned, many ups and downs were witnessed. The TFP index was the highest in 1986-87 (3.01) and the lowest in 1987-88 (0.30) in Punjab state. During the Period II, total input index has been decreasing constantly and reached the lowest ebb in 2004-05 (0.77). Thetotal output index and TFP index of cotton showed a wide variation over the period of time as the cotton crop was damaged during these years due to the severe attack of insect-pest and diseases. The TFP index was found to be than one since the year 1999-2000.

Determinants of Total Factor Productivity

The estimated parameters of TFP equation for Punjab are presented in Table 6. The results show that the number of regulated markets had a significant and positive

effect on TFP. Annual rainfall has a significant negative impact on productivity which may be due to large variations in the rainfall during these years.

Table 6: Determinants of Total Factor Productivity Growth in Punjab, 1990-91 to 2004-05

Variable	Parameters estimates
Intercept (constant)	6.771^{NS}
	(1.979)
June- August Rainfall	0.0883^{NS}
	(0.060)
Annual Rainfall	-0.216^{**}
	(0.099)
Agricultural Terms of Trade	0.140^{NS}
	(0.138)
Expenditure on R & D (`ha^{-1})	0.0960^{NS}
	(0.067)
Literacy- the proportion of rural literate population	-0.0007^{NS}
	(0.001)
Number of Regulated Markets per thousand ha of Gross Cropped Area	3.898^{***}
	(1.192)
R^2	**0.87**
Degrees of freedom	**13**

****** and ** significant at 1 and 5 percent level respectively***
NS: Non-significant.
Figures in the parentheses are Standard errors

The state experiences about 75 per cent of the total rainfall during the monsoon season in June to August months and has a positive impact on the growth of TFP. Agricultural terms of trade are a potentially important instrument to influence the efficiency and investments in agriculture, which showed a positive impact on TFP. The investment on R&D has a positive impact on TFP. The rural literacy as the measure of human capital in farming has the negative sign but is non-significant statistically. The results of decomposition of TFP confirm that market infrastructure, June to August rainfall, the agricultural terms of trade and investment on Research and Development (R&D) are the most important instruments of growth in TFP.

CONCLUSIONS

The predominance of paddy-wheat rotation which has serious repercussions in the form of soil health due to toxicity, alkalinity/salinity, micronutrient deficiencies and depletion of groundwater due to excessive mining of water which led to stagnation in growth of productivity and production in major crops in Punjab. The high profitability of rice-wheat crop production has led to the higher, if not excessive, input use. More reliance on chemical fertilisers and their imbalanced use has affected soil health. The TFP indices of paddy, wheat and cotton exhibited higher growth inPeriod-II (1990-91 to 2004-05) as compared to Period-I (1981-82 to 1989-90). This shows that the higher profitability was realised for these crops in Period-II as compared to the Period-1. The results of decomposition of TFP confirm that market infrastructure, June to August rainfall, the agricultural terms of trade and investment on research and development (R&D) were the most important factors of growth in TFP. The study highlighted the need for evolution of high yielding variety of crops, integrated use of balanced chemical fertilizers in conjunction with organic manures (compost and green manure), to promote integrated pest management and to increase the investment on R& D in order to achieve a sustained development of Punjab agriculture.

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Indian J. Econ. Dev.
Volume 8 No. 2 (2012): 63-73

PARTICIPATION AND EMPOWERMENT OF DALITS THROUGH PANCHAYATS: A SOCIOLOGICAL ANALYSIS

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ABSTRACT

The present study was undertaken to study the participation and empowerment of Dalits through Panchayati raj institutions. The study was conducted in two districts, Hoshiarpur and Jalandhar having highest number of Dalit Sarpanches and Panches of Punjab. The study did not find any overt case of conflict between Dalits and upper-castes. In most instances, both the groups had working relations. All the selected panchayats adhered to the norm of one-third reservation of seats for women and proportionate representation of Dalits. The main obstacle faced by the respondents while performing their duties was lack of grants and pre-set pattern of fund leakage. Social obstacle of male dominance and culture of silence were strong among women and more so in upper-castes. Few cases of upper caste dominance of Dalits were reported though they were in latent form. The results indicated that Dalits were well aware of their powers and were assertive. There was significant correlation between participation level of Dalits with gender and education and that of non-Dalits with gender and income. This calls for an effective implementation of legislative measures for institutionalization of panchayati raj institutions.

INTRODUCTION

At the outset, it may be pointed out that the term 'Dalit' signifies a broad canvass, yet in the present study we mean only the scheduled castes. Dalits constitute 15.75 per cent of countries and 28.85 per cent of State's population (Anonymous, 2010). From centuries they are suffering from economic backwardness, social disability, oppression and stigma and live at the mercy of upper castes (Juergensmeyer, 1982, Judge, 1993, 2003, Jodka, 2002, Shah, 2002, Dass, 2002 and Puri, 2004). There is a strong opinion that provision of reservation for marginalized sections has facilitated the election of Dalits and women to head the local bodies at all the three levels. Unlike earlier, weaker section have, now attained the capability to

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influence the social and political agenda. However despite the reservation in Panchayati Raj which was initiated mainly for the SC/ST and women participation in political and economic process somehow has not been successful in ensuring their participation in Panchayati Raj Institutions (Mishra, 1997 and Rahim and Singh, 2003).

Even after getting elected to local bodies they faced several problems in exercising their powers that are legally vested on them. The continuation of economic exploitation and socio-cultural oppression also has rendered them politically voiceless. Upper caste communities who have been controlling the affairs of village and rural community cannot tolerate the change that has been brought about by decentralized democratic institutions. It has been found that local body elections are still a nightmare experience for Dalits. Dalits were prevented from filling nominations and from voting. Number of houses and colonies were attacked by upper caste people. The elected Dalit representatives are forced to resign just after the elections. They faced many problems like threats for not to contest, forcing to resign and no-confidence motion and non-cooperation from other castes(Rao, 1996, Verma, 1997, Verma, 1998, Pinto, 2000, Prasad and Haranath, 2004 and Lambadari 2007). This has created cleavages and generated tensions leading to fighting, allegations and mutual suspicion and conflict between upper caste and lower caste. The different factions in upper caste join hand in terrorizing the lower castes (Mander, 1994, Sharma, 1995, Prasad, 1997, Shah, 1997, Lambadari 2007 and Anonymous, 2008, 2008a and 2008b).

After almost two decades of 73rd Amendment Act one need to take note of changes. Following the Weber's Model it is clear that Dalit have acquired legal rational authority. But the question that still needs to be answered is whether they are really empowered? Whether upper castes let them enjoy autonomy in true democratic sense? With these unanswered questions and controversies around these the present study was undertaken with following objectives:

i. to study the participation and empowerment of Dalits through Panchayati Raj Institutions and
ii. to examine the influence of socio-economic factors on the extent of participation of panchayat members.

METHODOLOGY

The study was conducted in 2010-11 in Punjab state. Jalandhar and Hoshiarpur having highest number of Dalit Sarpanches and Panches were selected purposively. As such Jalandhar district having 384 Dalit Sarpanches and 2409 Panches while in Hoshiarpur district there were 457 Dalit Sarpanches and 2647 Panches (Anonymous, 2010). At the next stage four blocks from each selected district were chosen randomly. At the third stage three villages from each selected block were chosen at random. Therefore, for the present study 24 villages from 8 blocks were selected randomly. From each sample village one dalit sarpanch, two each dalit and upper castes panchayat members were selected randomly. Thus, the total sample consist of 24 dalit sarpanches, 48 each of dalit and upper castes panchayat members, forming a total sample of 120 respondents. The data were collected on structured and open ended schedule through personal interview. A composite index of participation level ranging between 0-11 was computed for the dalits and upper castes.

Composite Index of Participation Level

For the comprehensive understanding of caste differences and gender differences in the participation level of different Panchayat duties, a composite index of participation level was computed for the dalits and upper castes. The detail of composite index is presented in Table 1.

Table 1: The variables used for construction of composite index of participation

Variable	Score assigned
Meetings attended	No meeting attended = 0, Occasionally =1 Once in four months = 2 and Once in three months = 3
Who attends meetings?	Husband / family members =0, Self but do not participate in decision making =1 and Self and participate in decision making =2
Undertaking different duties mentioned in 73rd Amendment	No duty undertaken = 0, Judicial =1, Judicial +anyone =2 and Judicial +more than one =3
Whether high castes involve dalit members in decision making?	No=0, Yes=1
Whether showed difference of opinion with high caste?	No= 0, Sometimes =1 and Yes=2
Level of participation, Low	(Dummy: 0-1), Average (Passive: 2-6) and High (Active: 7-11)

The range of this index varies between "0" and "11". Based on mean value of the index respondents were grouped under three broad categories of participation level that is high, average, low signifying active, passive and dummy participation of the respondents. The Chi-square Test (χ^2)was applied to examine the association between socio-economic variables and level of participation.

RESULTS AND DISCUSSION

Viewpoint of upper-castes panchayat members towards reservation is not positive for it reduces their age old dominance in local politics. Under this milieu the analysis of perceptions of upper-castes were pertinent along with that of Dalits. Only if upper-castes panchayat members cooperate with Dalits to participate on an equal level providing at least working climate, the objective of empowering the powerless could be achieved. In this light the further empirical analysis is carried out to look into the perceptions of both dalits and upper-castes on performing duties, participation level and conflict if any between the two to understand the power sharing equation. Though, the upper castes have no choice, except to comply with the legislation, there are plenty of evidences and instances that indicated discrimination in power sharing, blockades, caste based conflict and social despise and open disapproval because of persistent local traditions.

At present Punjab have 12775 Gram Panchayats of which 3651 are headed by females and 3484 by SC. The Gram Panchayats have 22255 female Panches and 20644 SC Panches (Anonymous, 2010). It was satisfactory to note that in Punjab the reserved categories for 'women' in general and 'Dalit' category comply with the norms of reservation as mandated in 73rd Amendment Act.

Participation of Panchayat Members in different Activities

Study empirically analyzed the extent of participation of the panchayat members in different activities and results are presented in Table 2. As regards the frequency of attending meetings it was observed that meetings were not held regularly in most of the cases. Even where meetings were held, not much discussion regarding development and welfare of village was held. Though, it is mandatory to hold one meeting in three months. It was reported by 43.05 percent of the dalits and 52.08 percent of the upper-castes respondents that meetings were held only when some agenda came up. It was reported by the dalits that in order to avoid any unsavory situation they avoided attending meetings on other hand the upper-castes were of the opinion that the dalits got instigated at slightest provocation.

In order to discourage the practice of 'proxy' presence state government had issued instructions to women members to be present in-person and male member of the family are not allowed to attend or represent women panchayat members. It was observed that these instructions were followed only at block and district level and not at village level. The upper-castes women (64.3%) suffered from 'male proxy' domination more than dalit (43.5%) women. Woman was proxy member where her husband/son was ex-panch/sarpanch.

Table 2: Participation of panchayat members in different activities

(Percent)

Activities/ Frequency	Dalits			Upper Castes		
	Male n=49	Female n=23	Total n=72	Male n=34	Female n=14	Total n =48
Level of participation						
Occasionally	32.65	65.22	43.05	47.06	64.28	52.08
Once in 4 month	40.82	21.74	34.72	32.35	35.71	33.33
Once in 3 month	26.53	13.04	22.22	20.59	0.00	14.58
Participation*						
Active	63.63	39.13	55.55	52.94	14.28	41.67
Passive	36.36	17.39	30.55	47.06	21.43	39.58
Proxy	0.00	43.48	13.89	0.00	64.28	18.75
Involvement in decision making						
Yes	77.55	34.78	63.89	-	-	-
No	22.45	65.22	36.11	-	-	-
Difference of Opinion						
Agree	69.39	34.78	58.33	-	-	-
Disagree	22.45	13.04	19.44	-	-	-
No reaction	8.16	52.17	22.22	-	-	-
Performing duties						
Judicial	86.36	50.00	72.22	63.15	40.00	58.33
Legislative	50.00	-	30.55	47.36	-	37.50
Administrative	63.63	-	38.88	47.36	-	37.50
Financial	77.27	-	47.22	73.68	-	58.30

Active participation denotes giving input in panchayat meetings, passive means just attending and proxy means not attending.

It is important to know whether dalits members were given due consideration or not in decision making. It was observed that dalits of Doaba Region were more informed and well aware about their rights. More than 60 per cent of Dalit respondents said upper castes involved them in decision making. Numerically preponderant, dalits did not let upper castes to dominate them. The study further highlighted that more than half of them were of the opinion that they agreed with the decisions of upper caste members. In depth analyses found that though outwardly caste did not ruled much as settling various community issues, Dalits got agreed with upper castes on various panchayat issues just to avoid the clash and disturbance in the Panchayat. While one fourth of them said that they did not react to the decisions whereas another 20 per cent dare to disagree with their decisions. Still half of the Dalit women felt that their opinion carried little weight. Even when they could put some views forward, their views were rarely taken seriously.

The power sharing equation among dalits and upper castes had marched towards egalitarianism. It was interesting to note that the dalits had become important allies for even upper castes in village politics. Dalits were more active in performing various duties than their counterparts. Judicial and financial duties were performed more than administrative and legislative ones. Women undertook only judicial duties which mainly included removing encroachments and penalizing the offender. More than half (58.3 %) of the upper castes undertook different judicial and financial duties and nearly one third (37.5%) took initiatives in legislative and administrative matters. Dalit males promptly undertook different judicial (86.4%) and financial (77.3%) works. Legislative initiatives mainly included reporting against erring officers and handover cases to higher authorities. Lot needed to be done at administrative and legislative front to bridge the gap between existing and desired level of initiatives.

Level of Participation

The level of participation of the respondents is presented in Table 3. The higher the value of index, indicate higher of participation of the respondents in decision making of PRIs. The results show that both dalit males (65.31%) and females (17.39%) had higher level of participation as compared to the upper castes males (52.94%) and females (7.14%). Similarly, participation of dalit members was higher as compared to the upper castes. The respective composite was estimated to be 50.00 and 39.58 percent respectively. An average level of participation was higher in the case of upper caste members as compared to the dalits respondents. The composite index showed there was a marginal difference in the participation of dalits

and upper caste respondents was concerned as indicated by the estimated values of composite index.

Table 3: Levels of participation of panchayat members

(Percent)

Level of participation	Dalits			Upper Castes		
	Male n=49	Female n=23	Total n=72	Male n=34	Female n=14	Total n =48
Low (0-1)	10.20	47.83	22.22	5.88	64.29	22.92
Average (2-6)	24.49	34.78	27.78	41.17	28.57	37.50
High (7-11)	65.31	17.39	50.00	52.94	7.14	39.58

Obstacles in Performing Duties

Panchayat members mentioned various obstacles they faced in effective and efficient discharge of their duties. An attempt was made to find out the kind of hurdles they faced. The perusal of Table 4 revealed that on whole, the females especially the upper-castes mentioned fewer hurdles. One hurdle which was faced by both by both the Dalits (34.8%) and upper-castes (64.3%) was the prevalence of patriarchy, which puts restriction on speaking in front of/or against the elder male members. Women's mentioning fewer obstacles did not signify the prevalence of fewer problems but it was due to their lower level of participation.

Lack of grants was first among the obstacles mentioned equally by Dalits and upper castes. Dalit (69.44%) were more vocal in reporting about financial irregularities than upper castes (62.57%). A 'pre-set pattern' of fund leakages all along the service delivery system was reported. Few cases were pending after initiative under RTI.Study revealed a top-bottom structure of governance. Issuing ordinance omitting Section 19 in the Punjab Panchayati Raj Act 1994, thus, curtailing the power of panches to pass 'No Confidence Motion' against Sarpanch even if he indulge in corruption was considered a major blow to the spirit of decentralization and devolution of power through PRI's by majority. As such resentment was recorded more among upper castes (56.25%) than in Dalits (40.28%). Presenting the government side, Panchayat Secretaries contemplated this step in the larger public interest and an effort to curd factionalism and safeguarding Dalits position. Just one Panchayat Secretary for five or more village Panchayats was not adequate to provide

required monitoring, enthusiasm and directions needed by Dalits and women members.

Table 4: Types of obstacles in performing duties

(Percent)

Obstacles	Dalits			Upper caste		
	Male (n=49)	Female (n=23)	Total (n=72)	Male (n=34)	Female (n=14)	Total (n=48)
Top-bottom governance	44.89	30.44	40.28	67.45	28.57	56.25
Dominance of high caste	14.28	26.09	18.05	-	-	-
Lack of awareness	6.12	17.39	9.72	8.82	28.57	14.58
Leakage of funds	77.55	52.17	69.44	73.53	35.71	62.57
Lack of grants	75.57	47.83	66.67	76.47	57.14	70.83
Culture of silence	-	34.78	11.11	-	64.28	18.75

Association of Participation Level with Socio-economic Variables

The perusal of Table 5 showed the association of Participation level with various socio-economic variables of Dalit and upper-castes respondents. In either of Dalit and upper-castes respondents age showed no relationship with their participation level in various panchayats activities. As far as gender was concerned male showed significant association with the level of participation as 65.3 per cent of Dalit males and 52.9 per cent of upper-castes males had high level of participation as compared to just 17.4 percent of Dalit females and 7.1 per cent of upper-castes females. Education also showed significant association with level of participation for Dalits. Half of Dalit respondents who had low level of participation were just middle passed while among respondents who were above matric, 46.7 percent of them had high level of participation. Income of Dalits showed no significant association with level of participation while there was significant association between participation of upper-castes and their annual income. Half of the respondents having income up to ₹ 1.5 lakh had high level of participation.

Table 5: Relationship of socio-economic variables with the level of participation

(Percent)

Variables	Dalit				Upper Castes			
	Low	Average	High	χ^2	Low	Average	High	χ^2
Age (years)								
25-40	30.6	36.1	33.3		25.0	37.5	37.5	
41-60	23.8	28.6	47.6	1.36^{NS}	21.7	38.7	43.5	0.32^{NS}
Above 60	33.3	33.3	33.3		22.2	44.4	33.3	
Sex								
Male	10.2	24.5	65.3	7.10^{***}	5.9	41.2	52.9	15.98^{***}
Female	47.8	34.8	17.4		64.3	28.6	7.1	
Education								
Up to Middle	52.9	23.5	25.5		55.6	33.3	-	
Matric	28.0	36.0	36.0	6.94^{**}	17.4	39.1	43.5	1.96^{NS}
Above Matric	16.7	36.7	46.7		12.5	37.5	56.3	
Income (₹ per annum)								
Up to 100000	40.4	36.4	22.7		100	-	-	
100000-150000	26.5	32.3	41.2	3.43^{NS}	40.0	50.0	10.0	10.51^{***}
>150000	18.7	31.3	50.0		8.8	38.2	52.9	

******and **significant at 1 and 5 per cent respectively***

NS: Non-significant

CONCLUSIONS

Contrary to the assumptions and evidences provided by different studies on socio-economic, political and cultural exploitation of Dalits at the hands of upper castes the study did not find any overt case of conflict between the two. In most instances, both the groups enjoyed working relations. All the selected panchayats adhere to the norm of one-third reservation of seats for women and proportionate representation of Dalits. It was found that dalits were more aware, dynamic and assertive about their rights and duties. Both Dalit males and females had higher level of participation than their counterparts. It was noticed that women were mostly passive or proxy candidates. Not much caste based differences were found as for confronting

different obstacles were concerned. Both caste groups experienced lack of grants as major hurdle in performance. Leakage of funds all along the service delivery system was reported more by dalits than upper caste respondents. Top-bottom structure of governance was resented equally by both. Curtailing the power of panches to pass 'No Confidence Motion' against Sarpanch was considered a major blow to the spirit of decentralization and devolution of power through PRI's by majority. Social obstacle of male dominance and "culture of silence" were strong among women and more so in upper-castes. Few cases of upper caste dominance of Dalits were reported though they were in latent form. As education showed significant association with level of participation it could be inferred from the study that by educating panchayat representatives the level of participation could be further improved. In patriarchal India, male are still in dominant position which is exhibited by significant association of gender with level of participation. Upper castes with higher income had higher participation level. So it could be concluded that in the process of empowerment, education, gender and income came out to be determinant variables while caste slowly drifting to back stage. Dalits had now achieved a state of consciousness which not only had empowered them to say a firm 'no' to their hitherto dominators but also encouraged them to ask assertively for an equal share in the structure of power.

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Indian J. Econ. Dev.
Volume 8 No. 2 (2012): 75-85

CONSUMER PREFERENCE REGARDING ORGANISED FRESH FRUITS AND VEGETABLES RETAIL OUTLETS

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ABSTRACT

The study was conducted with the objectives to identify the various factors which influence consumer preferences and variation in consumers' preferences across different demographic variables for the purchase of fresh fruits and vegetables from the organized retail outlets. The total sample consisted of 150 consumers constituting 75 consumers each from the organized and un-organized fruits and vegetables retail stores, respectively. It was found that most important attributes for selection of stores were product quality, location and variety. The availability of all products under one roof and product variety were the most important factors due to which customers preferred organized stores over the unorganized ones. It was found that some of the demographic factors such as education, age and income of the consumers determine the consumer preference for organized vis-à-vis un-organized fresh fruits and vegetables retail outlets.

INTRODUCTION

In India, vegetables and fruits buying from small shops, carts or road side places has been very common. But the trend has changed in the recent years. People, in urban area purchase vegetables from attractive and air conditioned roomy chambers. The modern Indian consumer is seeking more values in terms of improved availability and quality, pleasant shopping environment, financing options, return and exchange policies, reasonable prices etc. Indians have slowly started to accept the changes in life as a part of the bigger changes in the economy (Kumar, 2005). It is believed that by 2040, India will be the third largest economy and even before that in 2025, its consumer market will be the fifth largest in the world (Kumar, 2005).

Organized retail constitutes only around 4 percent of the total retail sales in India, compared to 75-80 percent in developed countries such as the US, Japan and UK. It is spreading fast, though the growth is currently focused around cities and tier-

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1 towns (Reardon and Gulati, 2008). In India the organized food retail sector has been growing at annual rates between 16 and 50 percent over the past few years (Reardon and Gulati, 2008), starting from a small base. Despite the smaller size, share of the retailing sector is 44 percent of the total GDP. In employment generation, it is second only to the agriculture sector. Retail provides employment to around 35 million people (Sheth and Sharaf, 2009).

Organized retailing in Fresh Fruits and Vegetables (FFV) is gaining a lot of momentum in India with huge investment by leading Indian corporations in this area. Modern formats of supermarkets such as Reliance Fresh, Choupal Fresh, Food World, etc. promoted by different companies are emerging very rapidly in small and large towns around the country. From the development perspective, these changes have strongimplications for the small and marginal farmers. Experiences of Chennai, Hyderabad and Bangalore suggest that the development efforts in this area are based on three grounds: First, farmers associated with the modern value chains earn higher returns than selling to the traditional markets. Second, the modern supply chains have specific quality requirements which are easier to meet by the large and medium farmers andthe small farmers tend to get left out of these markets. Third, there are several successful examples of linking small farmers to these modern value chains with effort from government agencies, NGOs and development agencies. This knowledge presents strong grounds for a closer look at the emerging sector in India (Punjabi and Sardana, 2011). But success of these retail outlets depends a lot upon the consumer preferences.

Consumer preference is the choice among valued options available to a consumer. A study of consumer preferences can help the marketers identify those factors which help the consumer on making up his mind to select a product or place of purchase (Fife *et al.*, 2007).

Therefore, the present study was carried out with the following specific objectives:

i. to study the consumer preference regarding organized fresh fruits and vegetables retail outlets in Ludhiana city and
ii. to study the variation in preference across different demographic variables.

METHODOLOGY

The exploratory research design was used to carry out the study of the attitude and preference of consumers regarding organized fresh fruits and vegetables retail outlets in Ludhiana city in February, 2012. In order to achieve the stipulated

objectives of the study three organized retail outlets namely More, Easy Day and Reliance Fresh were randomly selected for the study. Keeping in view the time and resources 150 respondents were selected on the basis of their willingness to participate and share the information. The primary data were collected with the help of structured and non-disguised schedule containing close ended questions and questions based on 5-point scale. The schedule was divided into three parts. First part contained questions regarding the demographic profile of the respondents. It consisted of gender, age, occupation, educational qualification, family size and monthly income. The second part of the schedule included questions regarding consumer's visits to these outlets and reasons for visits. Third part contained the comparative analysis for preference regarding organized and unorganized outlets on the basis of various factors like price, quality, variety, ambience etc. The respondents were asked to rate these factors on 1-5 scale where 1 is the worst and 5 is the best. The respondents were also asked to rank location, price, quality and variety in the outlets of both the sectors on 1-5 scale where 1 is highly preferred factor and 5 being the least preferred. The data so collected was analyzed with the help of mean, standard deviation, t-test and ANOVA.

RESULTS AND DISCUSSION

Demographic profile of the respondents was analysed and consumer preference for organized fresh fruits and vegetables retail outlets were examined. The variations in preferences across different demographic variables were studied. The results are as presented below-

Demographic Profile of Respondents

Age wise analysis shows that half of the respondents who purchased fresh fruits and vegetables are in the age group of 20-30 years as shown in Table 1. It was found that among the customers the percentage of women (55.33 percent) was higher than men (44.60 percent), which shows that as compared to men, women more often go for purchasing of fruits and vegetables. On categorizing respondents on the basis of their education, it was found that 45.33, 38.66, 10.00 and 6.00 percent were graduates, post-graduates, 12^{th} and 10^{th} pass respectively.

The results pertaining to the family size of the customers showed that 78 percent of the respondents were having 3-5 members. Only 18 percent of the respondents had more than 6 members and rest were having family size of more than 8 members.

Table 1: Distribution of respondents according to different demographic variables

Demographic Variables	Frequency	Percentage	Demographic Variables	Frequency	Percentage
Age group (Years)			**Family size (No.)**		
20-30	76	50.66	3-5	117	78.00
31-40	43	28.66	6-8	27	18.00
41-50	26	17.33	>8	6	4.00
More than 50	5	3.33	**Education level**		
Gender			10^{th} pass	9	6.00
Male	67	44.60	12^{th} pass	15	10.00
Female	83	55.33	Graduation	68	45.33
Occupation			Post-graduation	58	38.66
Professional	19	12.66	**Family income (₹ pm)**		
Government service	13	8.66	5000-15000	9	6.00
Business	13	8.66	15001-25000	20	13.33
Private job	15	10.00	25001-50000	71	47.33
Student	44	29.33	> 50000	50	33.33
Housewife	46	30.66	-	-	-

The results presented in Table 1 show that majority of the respondents going to these outlets were housewives. It was further found that 29.33, 12.66, 8.66, 8.66 and 10 percent of the respondents were students, professionals, businessmen, public sector employees and private sector employees respectively.

The respondents were grouped into four categories on the basis of their monthly income. It was noticed that 47.33 percent of the respondents had monthly family income of ₹ 25000-₹ 50000 which was followed by 33.33 percent respondents with family income more than ₹ 50000 per month and 13.33 percent respondents with family income of ₹ 15001- ₹ 25000. Only 6 percent were in the range of family income of ₹ 5000-₹ 15000 per month.

Source of Purchase and Frequency of Visit

An attempt was made to find the places from where the respondents generally purchased fruits and vegetables. It was found that half of the respondents go only to unorganized outlets consisting of shops, rehriwalas and mandis. It was found that 28.66 percent respondents go to both organized and unorganized retail outlets whereas 21.33 percent respondents go to only organized retail outlets for purchase of vegetables and fruits.

Table 2: Distribution of consumers as per their source of purchase

Source of purchase	Frequency	Percentage
Organized outlets	32	21.33
Unorganized outlets	75	50.00
Both	43	28.66
Total	**150**	**100.00**

Frequency of Visit for their Purchases

The respondents were asked about the frequency of purchase of fruits and vegetables. Majority (41.33 percent) of the respondents purchased fruits and vegetables daily. It was noticed that 33.33 and 25.33 of the respondents purchased their requirements weekly and two times in a week respectively at the overall level. The split up of the data showed that 60.60 and 17.44 percent of the respondents in the organized and un-organized sector purchased the fruits and vegetables daily, respectively. The corresponding figures for the purchases made two times a week were estimated to be 15.15 and 29.06 percent respectively. Similarly 24.24 and 53.48 percent of the respondent purchased fruits and vegetables on daily basis in the above said sales outlets respectively (Table 3).

Table 3: Distribution of respondents according to their frequency of visits to organized fresh fruits and vegetables retail outlets

Frequency of visits	Organized outlets	Unorganized outlets	Both organized and unorganized outlets	Overall
Weekly once	20 (60.60)	15 (17.44)	15 (48.38)	50 (33.33)
Twice a week	5 (15.15)	25 (29.06)	8 (25.80)	38 (25.33)
Daily	8 (24.24)	46 (53.48)	8 (25.80)	62 (41.33)
Total	**33 (100.00)**	**86 (100.00)**	**31 (100.00)**	**150 (100)**

Figures in parentheses indicate percentages to the total

Distance Travelled for Making Purchases

The results presented in Table 4 revealed that 58.88 and 46.66 percent of males and females respectively travelled less than 3 km for making their purchase. It was noticed that 43.33 percent of the male preferred to travel for 3-6 km for

purchasing fruits and vegetables. The figure for female respondents was estimated to be 34.44 percent. On the other hand 13.33 and 4.44 percent of males and females respectively travelled 7 to 10 km to purchase of vegetables and fruits. This showed that male respondents preferred longer distance than female counter parts because they considered it is a fun to go out for shopping.

Table 4: Distance travelled by respondents for making purchases

(Number of respondents)

Distance travelled (Km)	**Male**	**Female**
Less than 3	28	53
	(46.66)	(58.88)
3-6	26	31
	(43.33)	(34.44)
7-10	8	4
	(13.33)	(4.44)
Total	**60**	**90**
	(100.00)	**(100.00)**

Figures in parentheses are percentages to the total.

Factors Responsible for Choice of Organized or Unorganized Store

An attempt was made to identify the factors which could be responsible for respondents' choice of organized or unorganized retail stores. A list of the possible factors was prepared on the basis of the study of literature. The respondents were asked to rate on five point scale, the extent up to which a certain factor influenced choice between organized and unorganized retail stores.

The findings presented in Table 5 reveal that price and faster work can't be regarded as ideal factors for making comparison between organized and unorganized sectors. People make comparison between the two on the basis of promotional schemes and the availability of everything under one roof as both of these have the highest scores. Cleanliness, ambience and variety are the other ideal factors for making comparison. Those consumers who preferred organized stores over the unorganized ones, did so on the basis of the factors like 'variety', 'everything available at one place', 'ambience', 'availability', 'cleanliness' and 'promotional schemes' whereas unorganized stores were not given higher rating than organized ones with respect to any of the listed factors by the respondents.

Table 5: Comparative analysis of organized and unorganized sector on basis of rates given to the factors

Factors	Organized outlets	Unorganized outlets	Standard deviation	t-value
Price	3.51	3.41	0.10	0.82^{NS}
Quality	3.89	3.38	0.51	3.29^{NS}
Variety	4.37	3.11	1.26	10.91^{**}
Location	3.85	3.41	0.44	2.64^{NS}
Service	3.95	3.24	0.71	4.48^{NS}
Everything at one place	4.61	2.65	1.96	18.11^{**}
Ambience	4.21	2.49	1.72	14.74^{**}
Faster work	3.64	3.48	0.16	1.06^{NS}
Availability	4.03	3.08	0.95	7.29^{**}
Convenience	3.81	3.46	0.35	2.64^{NS}
Cleanliness	4.53	2.52	2.01	17.07^{**}
Promotional schemes	4.32	1.93	2.39	23.50^{**}

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

Education and Preference for Retail Stores

It was found that ambience was a significant factor which affects the respondent's preference for organized outlets, with respect to their education. There is positive correlation of ambience with the rise in the level of education of respondents. Similarly, faster work and availability of the products were found to be affected by level of education of the respondents (Table 6). The level of education did not have any impact on other factors in determining their preferences.

As such the respondents remained indifferent with regard to quality, price, location, service, etc. while convenience, availability of products and promotional schemes were the factors affecting the consumer's preference for the unorganized outlets. Other factors turned out to be non-significant depicting that these factors did not affect consumer's preference and behavior in determining the choice for the purchases from the unorganized outlets. This clearly shows that there may be some other unspecified factors which were determining the consumer behavior as far as purchases from the unorganized outlets were considered (Table 6).

Table 6: Variation in consumer preference for organized vis-à-vis un-organized stores with respect to the education

Factors	Mean score up to 10th grade		Mean score up to 12th grade		Mean score up to graduation		Mean score up to post graduation		F- Value	
	ORO	UORO	ORO	UORO	ORO	UORO	ORO	UORO	ORO	UORO
Price	3.66	3.77	3.33	3.40	3.49	3.55	3.56	3.25	0.51^{NS}	2.11^{NS}
Quality	4.33	2.88	4.26	3.20	3.89	3.41	3.63	3.44	1.74^{NS}	1.73^{NS}
Variety	4.33	3.55	4.44	2.93	4.16	2.95	4.51	3.20	0.99^{NS}	1.86^{NS}
Location	3.77	3.33	3.86	3.06	3.67	3.50	4.03	3.34	2.00^{NS}	1.73^{NS}
Service	4.55	3.33	4.00	3.40	3.92	3.13	3.86	3.31	1.04^{NS}	0.71^{NS}
Everything at one place	4.55	2.22	4.60	3.00	4.49	2.70	4.67	2.60	2.46^{NS}	0.62^{NS}
Ambience	3.33	2.66	3.93	3.00	4.20	2.52	4.32	2.24	2.76^{**}	2.38^{NS}
Faster work	3.77	3.22	3.33	3.66	3.59	3.38	3.70	3.51	3.70^{**}	0.49^{NS}
Availability	4.33	3.55	4.00	3.00	3.95	3.38	4.12	2.96	3.84^{**}	3.24^{**}
Convenience	3.88	2.66	3.93	2.86	3.61	3.68	3.89	3.50	0.77^{NS}	2.63^{**}
Cleanliness	4.66	2.22	4.60	2.60	4.44	2.79	4.51	2.25	0.17^{NS}	2.26^{NS}
Promotional schemes	4.44	2.44	4.13	1.06	4.32	2.07	4.31	1.75	0.52^{NS}	2.84^{**}

ORO and UORO represent organized and un-organized retail outlets respectively.
***** Significant at 5 percent level***
NS: Non-significant

Income and Preference for Retail Stores

On the basis of their monthly income, it was found that price, service and cleanliness were the important factors which affect consumer's preference for organized outlets (Table 7).

Table 7: Variation in consumer's preference with respect to the monthly income of respondent for organized and un-organized outlets

Factors	Mean score for group ₹ 5000-15000		Mean score for group ₹ 15001-25000		Mean score for group ₹ 25001-5000		Mean score for the group with > ₹ 50000		F- Value	
	ORO	UORO	ORO	UORO	ORO	UORO	ORO	UORO	ORO	UORO
Price	4.25	3.37	3.80	3.10	3.38	3.49	3.45	3.41	3.68^{**}	0.80^{NS}
Quality	4.37	2.87	4.15	2.90	3.70	3.56	3.96	3.39	1.57^{NS}	3.17^{**}
Variety	4.25	3.25	4.35	2.60	4.25	3.26	4.56	3.05	1.34^{NS}	3.56^{**}
Location	3.87	3.37	4.05	3.10	3.59	3.40	4.13	3.54	2.53^{NS}	0.69^{NS}
Service	3.62	2.87	4.50	2.30	4.05	3.33	3.64	3.52	3.53^{**}	6.27^{**}
Everything at one place	4.12	3.50	4.70	2.15	4.66	2.73	4.58	2.60	1.35^{NS}	3.05^{**}
Ambience	4.00	3.50	4.15	2.4	4.18	2.53	4.31	2.31	0.40^{NS}	3.72^{**}
Faster work	3.87	2.87	3.55	2.95	3.63	3.80	3.64	3.33	0.19^{NS}	4.45^{**}
Availability	3.62	3.50	4.10	2.75	4.05	3.16	4.03	3.01	0.53^{NS}	1.64^{NS}
Convenience	3.37	4.37	3.90	2.90	3.71	3.29	3.98	3.76	2.05^{NS}	4.78^{**}
Cleanliness	3.75	3.37	4.55	2.00	4.63	2.61	4.49	2.45	2.85^{**}	4.32^{**}
Promotional schemes	4.00	2.62	4.25	1.45	4.33	2.11	4.37	1.74	0.61^{NS}	5.29^{**}

ORO and UORO represent organized and un-organized retail outlets respectively.
***** Significant at 5 percent level***
NS: Non significant

These factors turned out to be statistically significant. It was noticed that other factors did not affect the purchasing behavoiur of the consumer as far as level of income was concerned in the case of organized sales outlets. It was found that the respondents with lower incomes preferred unorganized outlets for their purchase over the organized outlets due to the lower price in the case of former one. The results further revealed that other factors such as service and cleanliness also affect the consumer buying behaviour with respect the monthly income in the case of organized outlets. In the case of un-organized sale outlets factors such as quality, variety, service, everything at one place, ambience, faster work, convenience, cleanliness and promotional schemes affects the consumer buying behavoiur with respect to monthly income significantly. Other factors were found to be statistically non-significant which show that these factors did not affect the buying behavior of the consumers as far as the purchases of fruits and vegetables were concerned in both the sale outlets.

Age and Preference for Retail Stores

The perusal of Table 8 revealed that the young consumers were more concerned with the quality of the products whereas aged ones were more concerned about the location of the outlet.

Table 8: Variation in consumer's preference due to different age groups for organized outlets and un-organized outlets

Factors	Mean score of age group 20-30 years		Mean score of age group 31-40 years		Mean score of age group 41-50 years		Mean score of age group > 50 years		F-value	
	ORO	UORO	ORO	UORO	ORO	UORO	ORO	UORO	ORO	UORO
Price	3.59	3.36	3.48	3.30	3.32	3.64	3.20	3.80	1.08^{NS}	0.72^{NS}
Quality	3.89	3.35	4.32	3.06	3.28	3.96	3.00	3.60	4.77^{**}	2.80^{**}
Variety	4.31	4.31	4.41	3.11	4.52	3.84	4.20	3.60	0.57^{NS}	1.14^{NS}
Location	3.92	3.92	4.11	3.18	3.16	4.00	4.00	3.40	3.28^{**}	1.62^{NS}
Service	3.90	3.90	4.37	3.27	3.48	3.96	3.40	3.20	3.23^{**}	3.59^{**}
Everything at one place	4.53	4.53	4.76	2.65	4.68	2.88	4.20	2.40	1.44^{NS}	0.28^{NS}
Ambience	4.12	4.12	4.20	2.46	4.56	2.88	3.80	2.40	1.34^{NS}	1.29^{NS}
Faster work	3.66	3.66	3.83	3.53	3.24	4.12	3.60	2.80	1.21^{NS}	3.59^{**}
Availability	3.92	3.92	4.39	2.90	3.8	3.08	3.80	2.80	2.39^{NS}	0.84^{NS}
Convenience	3.80	3.80	4.11	3.37	3.44	3.80	3.20	3.40	4.30^{**}	0.75^{NS}
Cleanliness	4.45	4.45	4.55	2.46	4.68	3.08	4.60	2.40	0.60^{NS}	3.12^{**}
Promotional schemes	4.35	4.35	4.39	1.97	4.12	2.12	4.20	2.00	0.65^{NS}	0.80^{NS}

ORO and UORO represent organized and un-organized retail outlets respectively.
***** Significant at 5 percent level***
NS: Non-significant

The results further revealed that factors like location, service and convenience also affect buying behaviour of the consumer in respect to different age

groups. Other factors turned out to be statistically non-significant in the case of organized vegetable and fruit outlets. It was found that quality, service, faster work and cleanliness were the factors found to be affecting consumer's preference for unorganized outlets for their purchases. Other factors turned out to be non-significant.

Gender and Preference for Retail Stores

It was found that in both unorganized and organized outlets, gender of a person has no role to play in affecting his/her preference for the purchases in respect of fresh fruits and vegetables (Table 9).

Table 9: Variation in consumer's preference with respect to gender

Factors	Mean score of males in ORO	Mean score of females in ORO	t-value	Mean score of males in UORO	Mean score of females in UORO	t-value
Price	3.44	3.56	0.44^{NS}	3.44	3.39	0.65^{NS}
Quality	3.74	3.98	0.17^{NS}	3.46	3.31	0.36^{NS}
Variety	4.28	4.47	0.26^{NS}	3.25	2.96	0.55^{NS}
Location	3.89	3.80	0.68^{NS}	3.41	3.42	0.96^{NS}
Service	3.88	4.00	0.47^{NS}	3.25	3.24	0.89^{NS}
Everything at one place	4.44	4.74	0.01^{NS}	2.68	2.60	0.74^{NS}
Ambience	4.00	4.37	0.01^{NS}	2.56	2.42	0.40^{NS}
Faster work	3.76	3.53	0.18^{NS}	3.23	3.67	0.02^{NS}
Availability	3.95	4.08	0.36^{NS}	3.14	3.01	0.42^{NS}
Convenience	3.79	3.82	0.75^{NS}	3.40	3.50	0.60^{NS}
Cleanliness	4.40	4.63	0.10^{NS}	2.46	2.56	0.53^{NS}
Promotional schemes	4.37	4.26	0.44^{NS}	1.91	1.92	0.84^{NS}

ORO and UORO represent organized and un-organized retail outlets respectively.
NS: Non significant

CONCLUSIONS

It was found that among the respondents the percentage of women (55.33 percent) was higher than men (44.60 percent), which shows that female respondents more often go for purchasing of fruits and vegetables than male respondents. The results revealed that half of the respondents preferred unorganized sector for their purchases due to better location. More than 54 percent of the respondents preferred to purchase fruits and vegetables without travelling too much. It was further found that respondents preferred organized outlets because of the availability of all products

under one roof, large variety of fruits and vegetables, fixed and lower prices which relieve them from negotiating with the vegetable and fruit vendors. Similarly, the consumers preferred the organized over unorganized outlets on the basis of quality, variety, location, service, ambience, cleanliness and promotional schemes.

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Indian J. Econ. Dev.
Volume 8 No. 2 (2012):87-96

PRODUCTION PERFORMANCE AND CONSTRAINTS IN FISH FARMING IN MANIPUR

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ABSTRACT

The present study was conducted to examine the production performance, yield gaps and the constraints faced by the fish farmers in Manipur. In order to achieve the stipulated objectives, 100 fish farmers wereselected randomly from Thoubal district of MAnipur. The farmers were divided into two categories on the basis of fish stocked area. The Category-I comprised of the farmers having stocked area less than one hectare and Category-II consist of the farmers having stocked area of one hectare and above. The results revealed that the Category-I fish producers were more efficient as compared to Category-II farmers as far as realized yield of fish was concerned. The index of realized potential yield was found to be 62.70 and 42.08 per cent for Category-I and II farms respectively. This shows that Category-I have scope to increase the actual farm yield by 37.3 per cent. Similarly, 57.92 per cent scope was there to increase the actual farm yield in Category-II farmsif the sample farmers adopt the package of practices followed by the research farm.The farmers faced problems on account of non-availability of seeds, manure, fertilizers, high cost of labour, marketing of fish, and inadequate credit. Keeping in view the constraints faced by the respondents it seems that the fish farming in the state is not conducive to the interest of the farmers.

INTRODUCTION

India is the second largest producer of inland fish in the world with the production of 4.87 million tonnes during the year 2009-10 (Anonymous, 2010-11). This show that fish culture is being considered as a promising income and employment generation avocation in India (Srivastava, 2004). Fish production plays an important role in the socio-economic life of India. It is also an important source for income and employment to millions of rural farmers, particularly women. The

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sector stimulates growth of a number of subsidiary industries and is a source of earning foreign exchange.

The total fish production in North East Region was found to be 246.69 thousand tonnes in 2006-07. Manipur being the third highest producer with total production of 18.61 thousand tonnes has the great potential to increase the production of fish. Fishery plays important role in economic development of Manipur. It contributes three percent to the gross domestic product (GDP) of the state (Anonymous, 2003-04). In spite of this, the total water areas in Manipur state have shrunk from around one lakh hectares in 1990 to around 0.56lakh hectares in 2007-08 (Anonymous, 2008).

The state has vast potential of fisheries resources comprising ponds, tanks, natural lakes, marshy areas, swampy areas, rivers, reservoirs, submerged cropped land, low lying paddy fields, etc. The swamps and marshy areas are lying barren without any effective utilization. The lakes, reservoirs, beels, tanks, canals, etc. cover an area of about 13,222 hectares whereas rivers, streams, etc. accounted for 13,888 hectares. These swamps can be profitably utilized for culture of various indigenous natural fishes such as Ukabi (*Anabas tesdudineus*), Ngamu (*Lata fish*), Ngaton (*Labeobata*), Ngakrijou (*Lepidocephalichthys SPP*), SarengKhoibi (*Botia SPP*), Nganap (*Pengia SPP*), Ngatin (*LabeoPangusia*), Ngakra (*Barbus tor*), Ngasang (*Esomusdenricus*), Phabounga (*Puntius SPP*), Ngamhai (*Chanda SPP*), Pengba (*Osteobramabelangeri*), etc.

The total demand of fish was 27.50 thousand tonnes whereas the actual fish production was 19.20 thousand tonnes in 2009-10. It has been reported that, the supply was 8.85 kg as compared to the estimated requirement of 12.67 kg with a shortfall of 3.82 kg per capita per annum in 2009-10. The total demand of fish far exceeds its indigenous production. The large quantities of fish were being brought from outside the state every year to fill this gap. At present, the shortage was partly met by importing fish from other states like Assam, West Bengal, Andhra Pradesh, etc. On the basis of the national level of production, Manipur has got a production potential of about 38,000 tonnes of fish per annum if harnessed the un-tapped fisheries resources through judicious exploitation and application of modern scientific fish culture techniques.

The increase in fish production is possible only through increase in area under fish cultivation and/or enhancing productivity of fish. The yield gap was found

to be one of the reasons for low production of fish in Manipur. In the backdrop of this, the present study was conducted with the following objectives

i. to examine the performance of fish production in Manipur,
ii. to examine the yield gap in fish production and
iii. to identify the problems/constraints faced by the fish farmers.

METHODOLOGY

The state comprises of nine districts, of which five districts are hilly and four are plain. The fish farming is confined to all the districts but fish farmers are concentrated in the four districts of valley region. A multistage sampling technique was employed to select district, sub-divisions, villages and fish farmers. Out of the four plain districts, the Thoubal district was selected purposively for the study having the highest number of fish producers among the four districts. Above all, the district was one of the highest producers of fish among the four districts. The Thoubal district consists of three sub-divisions namely Thoubal, Lilong and Kakching. Keeping in view the concentration of fish producers four, ten and eleven villages were selected randomly from Thoubal, Lilong and Kakching sub-divisions respectively. The four farmers who cultivate fish were selected randomly from each of the samples village thus, forming a sample of 100 fish farmers.

The farmers were then divided into two categories on the basis of fish stocked area. The Category-I comprised of the farmers having stocked area less than one hectare and Category-II consist of the farmers having stocked area more than and equal to one hectare. Accordingly, 41 and 59 farmers were selected from Category I and II respectively. The primary data pertaining to the yield of fish and the constraints faced by the fish farmers were collected through personal interview. The secondary data relating to the production of fish and fish seed, yield of fish in the research station, etc. were collected to meet the objectives of the study. The analytical tools used for the analysis of data in the present study are discussed below:

Compound Growth Analysis

For the evaluating the trend in production of fish in Manipur, an exponential form of the growth function was used as follows:

$Y_t = ab^t$

Where,

Y_t = Production/area/yield of a crop for the year‘t’.

a = Intercept indicating Y in the base period (t = 0).
b = (1 + r).
r = Compound growth rate.
t = Time period.

The model is linearized by means of logarithmic transformation, giving

$\ln Y_t = \ln a + t (\ln b)$

The slope coefficient of b measures the relative changes in Y for a given absolute change in the value of explanatory variable't'. Therefore, the compound growth is estimated finally by using the following equation;

$\ln b = \ln (1 + r)$

$r = [\text{antilog} (\ln b) - 1]$

$CGR = [\text{antilog} (\ln b) - 1] \times 100$ or $[r \times 100]$.

Yield Gap Analysis

The yield gap was defined as the gap in fish production per unit of area between the highest yields (constant) achieved within the sample and yield achieved by the sample fish farmers (Laila *et al.,* 2004).The yield gaps have at least two components. The first of these cannot be narrowed, is not exploitable, and mainly owes to factors that are generally not transferable, such as the environmental conditions and some of the built-in technologies that are available at research stations or experimental farms. The second component arises when farmers use amounts of inputs and cultural practices different from the ones required to achieve the potential yield (Duwayri *et al*., 2000) and is mainly the result of differences in management practices.

The total yield gap (YG) which is the difference between the potential yield (Y_p) and the actual farm yield (Y_a). Where,

$YG = Y_p - Y_a$

The total yield gap (YG) has been split into two components namely (YG_1) and (YG_2).

$YG = (Y_p - Y_d) + (Y_d - Y_a)$

$YG_1 = Y_p - Y_d$

$YG_2 = Y_d - Y_a$

Where,

Y_p= Potential yield as obtained at the research station.
Y_a = Actual farm yield taken as the average of the yield of farms.
Y_d = Potential farm yield which is the highest yield among the farms

Index of Realized Potential Research Station Yield (IP)

It is the ratio of the actual farm yield (Y_a) to the potential research station yield (Y_p) expressed in percentage. Thus,

$$I_p = \frac{Y_a}{Y_p} \times 100$$

Index of Realized Potential Farm Yield (I_F)

It is the ratio of the actual farm yield (Y_a) to the potential farm yield (Y_d) expressed in percentage. Thus,

$$I_F = \frac{Y_a}{Y_d} \times 100$$

The yield gaps and its indices were worked out separately for Category-I and II farms.

Problems and Constraint faced by the fish farmers

A set of constraint items was prepared initially from available literature, journals and books as well as in consultation with experts. In the study only those items were included which were relevant to the fish cultivation to measure the degree of constraints. Thus, the total of twelve constraints wasidentified. Each constraint was ranked based on the frequency distribution of the constraints faced by the sample farmers. The constraint with the highest frequency were given the highest rank, next highest were given the second rank. Eventually, the least frequency was given the lowest rank.

RESULTS AND DISCUSSION

The results obtained from the analysis of data are discussed as under.

Fish Production

The production of fish was 16.60 thousand tonnes in 2002-03, which was increased to 19.20 thousand tonnes in 2009-10, by registering 16 per cent growth in production during the above said period. Nevertheless, the requirement of fish in the state was not met. This might be due to increased demand and declining in number of fish farm in the state. However, the difference between targeted and actual production of fish was lower in 2002-03 (0.40 thousand tonnes) against 0.50 thousand tonnes during 2009-10 (Table 1).

The compound growth rate for fish production, seed production and estimated requirement over a period of eight years were estimated to be 1.80, 1.11 and 1.65 per cent per annum respectively. It has been reported that, the supply was 8.85 kg as compared to the estimated requirement of 12.67 kg with a shortfall of 3.82 kg per capita per annum in 2009-10. The similar results were encountered for the other years under study. This shows that there is scope for the expansion of fish production due to increased demand for fish in Manipur.

Table 1: Production of fish and fish seed of Manipur, 2002-03 through 2009-10.

(000' tonnes)

Year	Fish Production		Fish Seed Production (Million No.)		Fish Seed Farms	Estimated Requirement of Fish
	Target	Achievement	Target	Achievement		
2002-03	17.00	16.60	117.00	117.00	19	27.36
2003-04	17.50	17.60	117.50	117.00	19	23.83
2004-05	18.00	17.80	118.00	118.00	18	23.00
2005-06	21.50	18.22	119.00	123.00	18	25.25[@]
2006-07	22.00	18.53	120.00	120.00	18	27.50
2007-08	22.00	18.65	119.00	120.00	18	27.50
2008-09	19.50	18.80	125.00	125.00	18	27.50
2009-10	19.70	19.20	134.00	127.00	18	27.50
CGR (%)	2.65[***]	1.80[***]	1.55[***]	1.11[***]	-	1.65[**]

@ Estimated,

****** and ** significant at one and five percent level respectively.***

Yield Gap

The extent of yield gaps on the sample fish farmers is presented in Table 2. The results showed that the annual average fishyield realized by the fish farmers at the overall level was estimated to be 1302.60 kg per hectare. The Category-I and II fish farmers realized the annual average yield of 1567.7 and 1052.20 kg per hectare respectively. On the overall level, the potential yield was estimated to be 2419.0 kg per hectare which was about 96.77 per cent of the highest reported annual experimental station yield (2500 kg ha^{-1}). The corresponding figures for Category-I and II were found to be 2419.0 and 2343.2 kg per hectare respectively. These formed 92.96 and 96.77 percent of the highest reported annual yield of the selected experimental research farm. The average yield of farm has declined with increase in pond size indicating an inverse relationship. The YG_1 at the overall was estimated to be 80.98 kg per hectare per year. The respective figures for Category-I and II were came out to be 80.98 and 175.83 kg per hectare per year respectively. Similarly, the YG_2 for above said categories was estimated to be 1116.42, 851.34 and 1271.93 kg per hectare per year respectively. The total yield gaps were similar as in the case of YG_1 and YG_2 for the above said categories. Therefore, the YG_1, YG_2 and total yield gap were lower for Category-I than that of the Category-II. A small yield gap

indicates that the available technologies are almost fully used. A large yield gap on other hand implies that farmers did not fully adopt the existing technologies because economic conditions made them unattractive. The yield gap may also be arise due to the differences in management practices and may be due to deficiencies and lack of knowledge of the production technology. Pingali and Heisey (1999) advocated that efforts to narrow down the yield gap without considering economic aspects may be counterproductive and may actually result in inefficient allocation of inputs and thereby reducing farmers' incomes.

Table 2: Yield gap between highest (potential) yield and realized according to farmer categories

(Kg ha^{-1})

Category	Y_p	Y_a	Y_d	Yield Gap-I	Yield Gap-II	Total yield gap	I_p (%)	I_F (%)
1	2	3	4	5 (2-4)	6 (4-3)	7 (5+6)	8	9
I	2500[1]	1567.7	2419.0	80.98	851.34	932.32	62.70	64.80
II	2500[1]	1052.2	2324.2	175.83	1271.93	1447.76	42.08	45.27
Overall	2500[1]	1302.6	2419.0	80.98	1116.42	1197.4	52.10	53.84

[1]***Potential yield at the Research Station, Department of Fisheries, Lamphel.***

The results presented in Table 2 further revealed that on an average the index of realized potential yield was 52.10 per cent. The index of realized potential yield was found to be 62.70 and 42.08 per cent for Category-I and II farms respectively. This shows that Category-I was more efficient as compared to Category-II farms which imply that there is scope to increase the actual farm yield by 37.3 per cent, if the sample farmers adopt the package of practices followed in the research farm. Likewise, 57.92 per cent scope was there to increase the actual farm yield in Category-II farms.

Index of realized potential farm at the overall level was estimated to be 53.84 per cent. The corresponding figures were estimated to be 64.80 and 45.27 per cent for Category-I and II farms respectively (Table 2). This implies that the sample farmers followed different package of practices of fish production. It seems that the Category-I farmers adopted the modern technology more intensely in fish farming than that of the Category-II farmers.

Therefore, it has been realized the scope of 35.2 per cent to increase the fish production in the study area under Category-I farms. While Category-II farms have scope of 54.73 per cent fish production, contributing to lack of scientific method of fish farming. The findings brought into limelight that the farmers in the study area were ignorant of modern technique of fish production such as cost effective method, the cultivation of fish as per food habit (surface, middle and bottom feeders).

Problems and Constraints faced by the Fish Farmers

The sample fish farmers faced a variety of problems and constraints in fish farming which are presented in Table 3. It was found that 90 per cent of respondents expressed that lack of training facilities relating to new technology affects the fish production adversely. Similarly, 80 per cent of the respondents reported the problem of lack of storage facility and credit. Due to non-availability of credit facilities in the study area the farmers were not able to adopt new technologies which ultimately affect the productivity. The findings of the present study are in line with the studies conducted by Das (1976, Lakshmanam (1979), Ranadhir, Tripathi and Baruna (1979) and Dasgupta (1979). The farmers were of the opinion that timely flow of funds in sufficient amount will help them to adopt modern technologies for augmentation of productivity of fish. On the other hand, fish is one of the most perishable food stuffs which require proper cold storage facility.

The results further revealed that 70 per cent of the respondents were facing problems on account of poor water management, scarcity of water and lack of drainage during flood. As many as 65 percent of the respondents faced the problems of ever increasing cost of labour and other inputs such as tools and implements which was the major inputs needed in the production process. The lack of contact with fishery extension personnel was also faced by 65 per cent of the sample fish farmers.

It was found that 60 per cent of the respondents were facing the problems on account of scarcity and untimely availability of fingerlings and its high price. The lack of information about the technology of fish culture is another problem faced by them. As the supply of seed of carps (fingerlings) from government fish farms and cooperative fisheries were limited and private dealers charge higher rate, for fingerlings. There is a need for the dissemination of adequate information about a new technology of fish cultivation to the fish farmers. Further, the results revealed that 50 per cent of the total respondents faced marketing problems. The farmers reported that they get low price of their product as large number of middlemen involved in the marketing of their product.

Table 3: Problems in fish production as perceived by the sample fish farmers

Sr. No	Perceived problems	Percentage	Rank order
1	Lack of training facilities relating to new technology	90	I
2	Lack of storage facilities	80	II
3	Financial problems	80	II
4	Lack of water management, scarcity of water and lack of drainage during flood	70	III
5	Increasing cost of labour and other inputs such as tools and implements	65	IV
6	Lack of contact with competent fishery extension personnel	65	IV
7	Scarcity and untimely availability of fingerlings and its high price	60	V
8	Lack of information about the technology of fish culture	60	V
9	Shortage and high price of manure (oil cake and rice bran) and fertilizers	55	VI
10	Marketing problems	50	VII
11	Disease and increasing cost of health care	40	VIII
12	Reliable source for the supply of seeds	20	IX

It was reported by 40 per cent of the respondents that they faced the problem due to occurrence of disease and increasing cost of health care of fish. The problem of reliable source for the supply of seeds (fry or fingerlings) was faced by 20 per cent of the respondents as the farmers were wholly dependent on the private dealers for the supply of fingerlings. The farmers sometimes faced the problem of lower productivity which was only because of poor quality of fingerlings that are easily susceptible to diseases.

CONCLUSIONS

The fish production is increasing but at a very slow rate and demand surpasses the available supply of fish in Manipur. This brings scope for increasing the fish production in the future by harnessing the untapped resources. The existence of yield gap indicated that there is need for intensifying the transfer of technology from the laboratory to the farmer's field. The identification of problems perceived by the farmers regarding seeds, manure, fertilizers and cost of labour, marketing of fish, financial aspect need to be addressed on priority. The farmers could be able to overcome these problems by

supplying these inputs at subsidized price, opening of more nursery farms, development of hatcheries, supply of good breed fingerlings, opening of market avenue, more contact with extension personnel, opening of fisheries clinics, increasing the level of education of fish farmers, proper credit facilities with incentives, etc.

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