

INDIAN JOURNAL OF ECONOMICS AND DEVELOPMENT

Volume 8**January-March 2012****No. 1**

A.K. Sandhu and B.R. Garg: Non-farm sector and women in the rural landless households of Punjab

Usha Tuteja and Subhash Chandra: Yields, costs and returns from horticultural crops: Evidence from field survey in Haryana

Amanpreet Kaur, J.L.Sharma and S.S.Chahal. Public investment in farm sector of Punjab: An impact analysis

Simpy, V.K. Sharma, Varinder Pal Singh and H. S. Kingra: Relationship between asset formation and indebtedness among Punjab farmers

Deepak Upadhyia and D.K. Grover: Behaviour and magnitude of changing climate pattern in central Punjab: A case study of Ludhiana district

Mini Goyal and Amandeep Singh: Production and marketing related problems of vegetable growers in Punjab

Simran Kang Sidhu and Shalini Sharma: Etiology of rural exclusion in higher education: A case of Punjab

Amandeep Singh and B.S.Tiwana: Impact of Border Area Development Programme on infrastructure improvement in Punjab



Indian Institute of Industrial Economics and Development Society

Indian Journal of Economics and Development

Editorial Board

Dr.S.S.Chahal	Senior Economist (Marketing) Department of Economics and Sociology Punjab Agricultural University Ludhiana-141004	Editor
Dr. R.K.Khatkar	Professor-cum-Head Department of Agricultural Economics CCS Haryana Agricultural University Hisar-125004	Member
Dr. V.K.Singh	Professor of Agricultural Economics Department of Agricultural Economics CCS Haryana Agricultural University Hisar-125004	Member
Dr. Ranveer Singh	Officer In-charge Agro Economic Research Centre Himachal Pradesh University, Shimla	Member
Mr. Anil Kumar Dogra	Director, Economic Policy and Taxation CII, New Delhi	Member
Dr. M.S.Toor	Professor of Economics Department of Economics and Sociology Punjab Agricultural University Ludhiana-141004	Member
Dr. Mini Goyal	Associate Professor Department of Economics and Sociology Punjab Agricultural University Ludhiana-141004	Member
Dr. J.M.Singh	Agricultural Economist Agro Economic Research Centre Department of Economics and Sociology Punjab Agricultural University Ludhiana-141004	Member
Dr. Parminder Kaur	Associate Professor Department of Economics and Sociology Punjab Agricultural University Ludhiana-141004	Member

ISSN 2277-5412

Indian Journal of Economics and Development



Indian Institute of Industrial Economics and Development Society

Indian Journal of Economics and Development
Volume 8 No. 1: 2012

© **Indian Institute of Industrial Economics and Development Society**

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

Regd. No. PUNE-NGO1265/19.01.2004

Email: editorijed@yahoo.com

Standing Council: S. Lakhwinder Singh Sandhu, Advocate

**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 Indian Institute of Industrial Economics and Development Society)

Volume 8

January-March 2012

No. 1

Contents

Editorial

- Non-farm sector and women in the rural landless households of Punjab. 1
A.K. Sandhu and B.R.Garg
- Yields, costs and returns from horticultural crops: Evidence from field survey in Haryana 11
Usha Tuteja and Subhash Chandra
- Public investment in farm sector of Punjab: An impact analysis 25
Amanpreet Kaur, J.L.Sharma and S.S.Chahal
- Relationship between asset formation and indebtedness among Punjab farmers 37
Simpy, V.K. Sharma, Varinder Pal Singh and H. S. Kingra
- Behaviour and magnitude of changing climate pattern in central Punjab: A case study of Ludhiana district 49
Deepak Upadhya and D.K. Grover
- Production and marketing related problems of vegetable growers in Punjab 63
Mini Goyal and Amandeep Singh
- Etiology of rural exclusion in higher education: A case of Punjab 71
Simran Kang Sidhu and Shalini Sharma
- Impact of Border Area Development Programme on infrastructure improvement in Punjab 79
Amandeep Singh and B.S.Tiwana

Indian Institute of Industrial Economics and Development Society

Office Bearers

Dr.S.S.Chhina	Professor (Retired) 72-Sector 4, Ranjit Avenue Amritsar-143001	President
Dr. P.Kataria	Senior Economist (QM) Department of Economics and Sociology Punjab Agricultural University Ludhiana-141004	Vice President
Dr. D.K.Grover	Director Agro Economic Research Centre Punjab Agricultural University Ludhiana-141004	Vice President
Dr. Narinderpal Singh	District Extension Specialist (FM) FASS (PAU), Amritsar-143001	General Secretary
Dr.S.S.Chahal	Senior Economist (Marketing) Department of Economics and Sociology Punjab Agricultural University Ludhiana-141004	Finance Secretary
Dr. Randeep Kaur	Associate Professor P.G. Department of Agricultural Economics Khalsa College, Amritsar-143005	Joint Secretary
Dr. Gian Kaur	Professor of Economics Punjab School of Economics GNDU, Amritsar	Member
Dr. J.S.Chhina	Extension Specialist (FM) Regional Research Centre Punjab Agricultural University Gurdaspur	Member
Dr. Jasdev Singh	Agricultural Economist Agro Economic Research Centre Punjab Agricultural University Ludhiana-141004	Member
Dr. Mandeep Singh	Extension Specialist (FM) FASS (PAU), Sangrur-148001	Member
Dr. Pratibha Goyal	Associate Professor Department of Business Management Punjab Agricultural University Ludhiana	Member

Particulars	Membership Fee	
	India (₹)	Other countries (\$)
Academics (Annual)	300	25
Academics (Life)	2000	250
Academics (Retired) (Annual)	150	-
Students (Annual)	150	-
Students (Life)	1000	-
Institutional (Annual)	1000	200

Membership should be paid by demand draft drawn in favour of Indian Institute of Industrial Economics and Development Society payable at Amritsar and be sent to the General Secretary/Treasurer of the Society. Indian Institute of Industrial Economics and Development Society, 72-Sector 4, Ranjit Avenue, Amritsar-143001

Editorial

During Economic Reforms 1991, liberalization, privatization and globalization were the three important prong of the Indian economy. Liberalizing foreign direct investment (FDI) was the important part of the reforms. With the belief that it would increase the total volume of investment in the economy, improve production technology, increase access to world markets and improve human resources. The FDI plays a vital role in the up gradation of skills and managerial capacities in various sectors of the economy. It is considered to be important in utilizing the economic resources and generating the employment in the country. The FDI has the three parts-equity capital investment, reinvested earnings and intra-company loans. India slipped 10 positions on the list of countries attracting the highest foreign direct investment and fell to fourteenth position in the 2010 list. According to UN survey, FDI in India declined to \$ 25 billion as against \$36 billion in 2011. As per UNCTAD's annual investment survey, the World Investment Report, FDI inflow to India was declined by 31 per cent. Huge investment in retail sector will see gainful employment opportunities in agro-processing, sorting, marketing, logistics, management and front-end-retail. In our country, 98 per cent of the total trade is covered by unorganized sector and only two per cent by organized sector. Recently cabinet approves 51 per cent FDI in multi-brand sector and 100 per cent in single brand retail. There has been assurance that the 50 per cent of the total FDI to be invested in backend infrastructure and 30 per cent of the products including agricultural products to be procured from small scale industries. FDI in multi-brand retail refers to the value at the time of the installation of plant without depreciation. It includes products sold under the same brand name internationally and allows retailing of products by the owner foreign investor. In the long run, the FDI can lead to greater efficiency and improvement of living standard and greater integration into the global economy. It can increase organized retail market size to \$ 260 billion by 2020. It has believed that FDI will create 10 million jobs in the next three years in the retail sector. On the producers' side, price realization for the farmers will increase by 10-20 per cent and eliminate middlemen increasing remunerative prices for their produce. It will ensure efficient supply chain. It will help in having a salutary impact on food inflation from efficiencies in supply chain. For the consumers, there will be a wider choice for the consumers with better option. There will be assurance of quality with greater transparency and easier monitoring of adulteration, counterfeit products and traceability. Despite of many advantages and influencing impact on economic growth, there is fear that this move will lead to large-scale job losses especially in country likes India, where the shopping density is highest in the world. There were 11 shops per 1000 people and 1.2 crores shops employing over four crores people. Almost 95 per cent of the small shops run by self employed people will be wiped out by supermarkets. There is dreadful night mare that the food supplies being controlled by foreign organizations and resort to monopoly/oligopoly pricing. It will be hard for the consumers who have low purchasing power. To bring a change in the economy have both side of impact. Last not the least, the kind of method should be adopted in order to bring growth in economy that minimizes the dependency on others.

Editor

NON-FARM SECTOR AND WOMEN IN THE RURAL LANDLESS HOUSEHOLDS OF PUNJAB

A.K.Sandhu and B.R.Garg*

Abstract

The present study was contemplated in the Central Zone of the Punjab state. Information on the important parameters including age, education, caste, occupation, employment status, nature and extent of employment and sources of income, etc pertaining to women from a sample of 120 rural landless households was obtained for the year 2006-07. A simple tabular analysis of the information thus collected revealed that among the rural landless households, majority belonged to the backward and the scheduled caste and a very few were from the general caste. The working women in Punjab were found to be employed mainly in the industries of community, social and personal (CSP) services, agriculture, manufacturing and trade. In the industry of CSP services, majority of the women were working as a regular employee. The women employed in the industries of manufacturing and agriculture preferred to work as an own account worker. And, in the industry of trade they were found to be working as an own account worker, a regular employee and as a casual worker. The income of the rural landless women employed with the industry of CSP services was relatively higher compared to that from the manufacturing industry and the agriculture. The annual earnings were found to be highest in the industry of trade but it accommodated a very few women. The results showed that agriculture was no more a popular occupation with the women in the rural landless households as it was gradually being replaced by employment in the relatively more paying industries like CSP Services, manufacturing and trade. The implications of the study are that the industries of CSP services and manufacturing hold much scope for rural landless women. The provision of imparting vocational training along with providing appropriate credit facilities to the rural landless women in the sample area will help set up small scale manufacturing industry in the area which will provide employment opportunities to the women and raise their income as well.

Introduction

Landless and unskilled workers are the poorest among the rural poor. The fast growth in population and its long dependence on agriculture has shown exit to many from the agriculture sector. They have no other option but to seek employment

* Research Associate, College of Dairy Science & Technology, GADVASU, Ludhiana-141004 and Senior Economist, Department of Economics and Sociology, Punjab Agricultural University, Ludhiana

in the insignificant non-farm sector or destined to work as seasonal labour in agricultural sector. They are vulnerable to fluctuating demand for labour, relatively low wage in agriculture and the rising food prices. The rural women tend to suffer far more than rural men on account of low social status due to their poor earning capacity in most societies of the world.

It is widely argued that rural women constitute one of the most vulnerable sections of our society. In India, the amount of drudgery per day of work was higher in women than men (Haffis *et al.*, 2005). The off-farm activities were predominantly the domain of males. The non-farm sector appeared to offer relatively a few real opportunities for women.

Irrespective of region, women were more likely to be employed in agriculture (Lanjouw and Shariff, 2004). For the improvement of socio-economic position of the agricultural labourers, there was a need for creating alternative sources of employment, improving the working conditions, regulation of hours of work, providing cheap credit for undertaking subsidiary occupation and proper training for improving the skills of farm labourers (Padhi, 2007).

There are few studies available on income and employment among rural landless households, particularly, with reference to women. In the wake of empowerment of women in the era of liberalization, privatization and globalization, it was important to carry out a study on women featuring their socio-economic background, nature and extent of their employment and income earned from various sources. The present study has been conducted in the Central Zone of the Punjab state where paddy-wheat is a predominant crop rotation.

Methodology

A multi-stage random sampling technique was used to select the sample. All the districts covered by the Central zone of Punjab were arranged in ascending order based on proportion of rural landless households in these districts. The districts having 65 per cent and above rural landless households (RLLHH) were considered to fall in the high intensity region. And, the districts having below 65 per cent RLLHH were taken to fall in the low intensity region.

One district, each from low and high intensity region was selected using simple random method to form the first stage sample units. At the second stage of sampling, two blocks were selected randomly from each of the two selected districts. Again, two villages were selected randomly from each of the four selected blocks, forming a total sample of eight villages. Keeping in view the National Industrial

Classification 2004 (Anonymous, 2004), all the rural landless households in each selected village were classified into nine groups. Finally, 15 RLLHH were selected randomly from each of the selected eight villages taking into consideration the percent households (HH) falling in each industry by occupation. Thus, we had a total sample of 120 rural RLLHH selected for the purpose of the present study.

Information on the important parameters including age, education, occupation, caste, employment status, nature and extent of employment and sources of income, etc. pertaining to women in the selected sample was obtained for the year 2006-07. Simple averages and percentages were worked out to analyze the information collected and arrive at the conclusions of the study. The analysis was carried out for the rural women belonging to the different social groups in order to understand how the non-farm sector benefited them in providing employment and raising their income.

Results and Discussion

Basic features of RLLHH women

It may be observed from Table 1 that majority of the RLLHH belonged to the backward caste (45.83 per cent) followed by scheduled caste (42.5 per cent) and a very few were from the general caste (11.67 per cent) category. The number of nuclear families was highest among the scheduled caste followed by the backward and the general class households. There was not much variation in years of schooling put in by women of any social class.

Table 1: Basic features of women in RLLHH, Punjab, 2006-07

Particulars	(Number)			
	General caste	Backward caste	Scheduled caste	Total
Households	14 (11.67)	55 (45.83)	51 (42.5)	120 (100)
Nuclear Families	8 (10.26)	34 (43.59)	36 (46.15)	78 (100)
Literate (%)	69.12	87.59	63.16	74.26
Years of schooling	9.23	7.89	7.73	8.08
Working women	21 (21.65)	35 (36.08)	41 (42.27)	97 (100)

Figures in parentheses indicated per cent to total

However, literacy level among women in the backward class was found to be relatively higher (87.59 percent) as compared to the scheduled caste (63.16 per cent) and even general caste (69.12 per cent) categories. To support the family, some of the women from RLLHH had to work outside. There were, in all, 97 working women in the sample of 120 RLLHH. The number of working women was higher among scheduled caste households (42.27 per cent) compared to 36.08 percent in the backward caste and only 21.65 per cent in the general caste. This may be attributed partly to relatively higher adoption of nuclear family structure in the scheduled and the backward caste and partly to the fact that general caste people, generally, do not allow their women to work outside in the rural area.

Employment and the industry

The distribution of women working with various industries in the Central Zone of Punjab during the year 2006-07 has been displayed out in Table 2. It may be observed from the Table 2 that out of the nine industries, the rural working women in Punjab found employment only with the four industries. These were agriculture, manufacturing, trade and CSP services. The industry of CSP services gave employment to highest number of women (42.27 per cent). The per cent share of women employed in agriculture, manufacturing and trade were 38.14, 12.37 and 7.22 per cent, respectively. Thus, the non-farm sector including the industries of CSP services, manufacturing and trade were providing employment to about 62 per cent rural landless women against 38 per cent being employed in agriculture.

Table 2: Distribution of women working with various industries, Punjab, 2006-07
(No. of Persons)

Industry	Caste Categories			Total
	General	Backward	Scheduled	
Agriculture	9 (9.28)	13 (13.40)	15 (15.46)	37 (38.14)
Manufacturing	2 (2.06)	7 (7.22)	3 (3.09)	12 (12.37)
Trade	2 (2.06)	4 (4.12)	1 (1.03)	7 (7.22)
CSP Services*	8 (8.25)	11 (11.34)	22 (22.68)	41 (42.27)
Total	21 (21.65)	35 (36.08)	41 (42.27)	97 (100)

Figures in parentheses indicate percent to total

** CSP Services denote Community, Social and Personal services*

Again, the share of the scheduled caste women finding employment with the industry of CSP services was observed to be higher (22.68 percent) as compared to backward (11.34 percent) and general class (8.25 per cent) women. The percent of women employed in agriculture was 15.46, 13.40 and 9.28 percent, respectively in the case of scheduled caste, backward and general class indicating that agriculture also accommodated relatively higher number of scheduled caste women.

The industry of trade employed a very few women. The per cent women employed with this industry was 2.06, 4.12 and 1.03 from the general, backward and the scheduled caste, respectively. On the other hand, the manufacturing industry accommodated relatively higher number of backward class women (7.22 per cent) compared to 3.09 and 2.06 per cent women belonging to scheduled and general class, respectively. Thus, the results showed that the industry of CSP services and agriculture found much favour with the scheduled caste and the backward class women while the industry of manufacturing was most favourite play of the backward class women.

Nature of employment

The nature of employment of RLLHH women working with various industries in the central zone of Punjab during 2006-07 has been shown in Table 3. The three categories of employment, namely own account worker, regular and casual/temporary worker were considered to study the nature of employment. Further, whether the woman had principal status or the subsidiary status of employment depending upon the major or minor share in income drawn and the time devoted to a particular profession was also considered for the study.

Employment status and the social class

It will be observed from the Table 3 that besides working in the principal status, a few women from all the social classes did find an opportunity to work in the subsidiary status in one or the other industry. In the general class, there were 21 women working with principal status, out of which three (14.29 per cent) found employment in the subsidiary status. Similarly, the number of backward class women finding employment with the principal status was 35 out of which 2 (5.71 per cent) got employed in the subsidiary status. In the scheduled caste category, there were 41 women working with the principal status out of which 6 (14.63 per cent) were employed with subsidiary status. The women with principal status found employment as an own account worker, a regular employee or as a temporary/ casual worker but women with subsidiary status got employment only as an own account worker in all the social categories of women.

Principal status of employment and the industry

The most important industry in which higher number of women got employment was CSP services. Out of the total women employed in a particular social class, the employment of scheduled caste women in the industry of CSP services was found to be 53.66 per cent, the general class women at 38.10 per cent and the backward class women at 31.43 per cent. The women employed as regular worker in the principal status (PS) were estimated at 48.78, 17.14 and 23.81 per cent, respectively in the scheduled caste, backward and general class categories. And, the women working on own accounts were found to be 2.44, 14.29, and 14.29 per cent, respectively in the said social classes. Only one woman got employed as an own account worker in the subsidiary status (SS) from the backward class and one each as an own account worker and as a casual worker from the scheduled caste class.

The results thus showed that in this industry, majority of the women with the principal status were employed as a regular employee. A very negligible per cent of rural landless women were found to prefer this industry for employment in the subsidiary status. In the industry of agriculture, the women employed with principal status in the general caste category were 42.86 per cent including 23.81 per cent engaged as own account workers and 19.05 per cent as casual workers. The percent of women employed in this industry with principal status in the case of backward class and scheduled caste categories was 37.14 and 36.59, respectively, and, the women working as own account worker and casual worker were 34.29 and 2.86 per cent in the former, and, 21.95 and 14.63 per cent in the latter social class, respectively. This showed that most of the women employed in agriculture industry with principal status preferred to work as an own account worker in comparison to enjoying the status of a casual worker and none got employment as a regular worker.

Next was the manufacturing industry in order of preference as far as employment of women from the rural landless households was concerned. There were 9.52 per cent of the general class women, 20 per cent of backward class women and 7.32 per cent of the scheduled caste women employed with this sector with the principal status. All the general class and scheduled caste women, and 17.14 per cent of the backward class women working in this industry were found to be working in the capacity of an own account worker. Only one woman from the backward class was found to be working as a regular employee. No woman was found to be working as a casual / temporary worker in the principal status from any of the social class. Similarly, there was no woman working in this industry as an own account worker, as a regular employee or as a casual worker assuming the subsidiary status. Thus, it may

be said that majority of the women in this industry got employment as an own account worker with principal status.

Table 3: Distribution of women by nature of employment and industry, Punjab, 2006-07

Industry	Nature of Employment						(No. of persons)	
	Own account worker		Regular	Casual worker		Total		
	PS	SS	PS	PS	PS	SS		
General								
Agriculture	5 (23.81)	2 (9.52)	-	4 (19.05)	9 (42.86)	2 (9.52)		
Manufacturing	2 (9.52)	-	-	-	2 (9.52)	-		
Trade	1 (4.76)	1 (4.76)	1 (4.76)	-	2 (9.52)	1 (4.76)		
CSP Services	3 (14.29)	-	5 (23.81)	-	8 (38.10)	-		
Total	11 (52.38)	3 (14.29)	6 (28.57)	4 (19.05)	21 (100.00)	3 (14.29)		
Backward								
Agriculture	12 (34.29)	1 (2.86)	-	1 (2.86)	13 (37.14)	1 (2.86)		
Manufacturing	6 (17.14)	-	1 (2.86)	-	7 (20.00)	-		
Trade	4 (11.43)	-	-	-	4 (11.43)	-		
CSP Services	5 (14.29)	1 (2.86)	6 (17.14)	-	11 (31.43)	1 (2.86)		
Total	27 (77.14)	2 (5.71)	7 (20.00)	1 (2.86)	35 (100.00)	2 (5.71)		
Schedule								
Agriculture	9 (21.95)	4 (9.76)	-	6 (14.63)	15 (36.59)	4 (9.76)		
Manufacturing	3 (7.32)	-	-	-	3 (7.32)	-		
Trade	-	1 (2.44)	-	1 (2.44)	1 (2.44)	1 (2.44)		
CSP Services	1 (2.44)	1 (2.44)	20 (48.78)	1 (2.44)	22 (53.66)	1 (2.44)		
Total	13 (31.71)	6 (14.63)	20 (48.78)	8 (19.51)	41 (100.00)	6 (14.63)		

Figures in parentheses indicate percent to total

PS: Principal status SS: Subsidiary Status

In the trade industry, the women employed with principal status were 9.52, 11.43 and 2.44 per cent and those employed with subsidiary status were 4.76 and 2.44 per cent, respectively in the general and the scheduled caste categories. The women from the general caste finding employment as an own account and a regular worker were 4.76 per cent each. All the backward class women employed in trade

industry were working as an own account worker and the women in the scheduled caste category were working as casual worker. The women employed with subsidiary status in the general and the scheduled caste classes were working as own account worker.

Rural landless women and their income

The average annual income earned by woman employed in different industries in the Central Zone of Punjab in 2006-07 has been presented in Table 4. The results show that the general caste woman with principal status of employment earned slightly higher than a backward or scheduled caste woman in the industries of agriculture and trade. The income earned per woman belonging to general, backward and the scheduled caste was ` 3555, ` 3349 and ` 2969, respectively in the industry of agriculture. The respective figures for the woman working in the industry of trade were ` 21000, ` 11040 and ` 18000, respectively.

Similarly, a backward class woman earned higher than a general and the scheduled caste woman in the industry of manufacturing and the CSP services. The income earned by the backward, general and the scheduled caste woman worked out to be ` 4920, ` 2400 and ` 3360 in the industry of manufacturing, and ` 10774, ` 8200 and ` 8449 in the industry of CSP services, respectively.

Further, it was revealed that the income earned with principal status of employment was highest in the case of a regular backward class woman worker employed in the industry of CSP services (` 18533) as compared to its counterpart in the general class (` 11320) and a scheduled caste woman (` 9090). Next to it was the casual worker status where the overall average income earned was highest in the case of a scheduled caste woman (` 7235) as compared to backward class (` 6720) woman and general class (` 6470) woman.

In the case of an own account worker with principal status of employment, it was observed that overall average income per person was highest for the general caste woman (` 4538) followed by backward class (` 3745) and scheduled caste (` 1447) woman. The difference in their income can be attributed to higher income of general caste women in the industry of trade. For the women employed with subsidiary status, the overall average income worked out to be highest for a scheduled class woman (` 3260) followed backward class woman (` 1750) and general caste woman (` 1301).

The overall average income per woman over different industries and nature of employment and with the principal status of employment was found to be almost same for the different caste women as it was ` 6876 for the general caste woman, ` 6875 for the backward class and ` 6305 for the scheduled caste woman.

Table 4: Income of rural landless women by nature of employment, Punjab, 2006-07
(₹ Annum^{-1})

Industry	Nature of Employment				Total	
	Own account worker		Regular	Casual worker		
	PS	SS	PS	PS	PS	SS
General						
Agriculture	1224.00	1051.59	-	6470.0	3555.56	1051.59
Manufacturing	2400.00	-	-	-	2400.00	-
Trade	30000.00	1800.00	12000	-	21000.00	1800.00
CSP Services	3000.00	-	11320	-	8200.00	-
Overall average	4538.18	1301.06	11433.3	6470.00	6876.19	1301.06
Backward						
Agriculture	3068.33	960.45	-	6720.00	3349.23	960.45
Manufacturing	2140.00	-	21600	-	4920.00	-
Trade	11040.00	-	-	-	11040.00	-
CSP Services	1462.00	2540.00	18533.30	-	10773.60	2540.00
Overall average	3745.50	1750.23	18971.40	6720.00	6875.71	1750.23
Schedule						
Agriculture	651.11	391.25	-	6446.70	2969.33	391.25
Manufacturing	3360.00	-	-	-	3360.00	-
Trade	-	3600.00	-	18000.00	18000.00	3600.00
CSP Services	2880.00	14400.00	9090.00	1200.00	8449.09	14400.00
Overall average	1447.69	1200.83	9090.00	7235.00	6304.88	3260.83

The industry of trade provided highest per capita income to women irrespective of the caste they belonged to but it accommodated the lowest number of women in this profession. Next was the industry of CSP Services which provided employment to maximum number of women, particularly belonging to the scheduled caste, and from which the earnings per person for all caste women were higher than those from any other industry except that from trade. Next in importance was the industry of manufacturing for the backward and scheduled caste women and agriculture for the general caste woman as far as the earnings were concerned.

Conclusions

The majority of working women belonged to the scheduled and the backward caste and a very few were from the general caste. The literacy level among women in the backward class was found to be relatively higher as compared to that in the general and the scheduled caste. It was observed that the industry of CSP services

employed maximum number of women as compared to the industry of agriculture, manufacturing and trade. The industry of CSP services and agriculture found much favour with the scheduled and the backward class women. It was further revealed that women with principal status found employment as own account worker, a regular employee or as temporary/casual worker but women with subsidiary status got employment only as an own account worker. And, most of the women employed in agriculture industry with principal status preferred to work as an own account worker.

The overall per capita income of rural landless women was very low irrespective of the social class one belongs to. And, the income from agriculture was very low as compared to that from any other industry. The overall average income per woman with the principal status of employment over all the industries was found to be almost same for the different caste women. The industry of trade provided maximum per capita income to women irrespective of the caste they belonged to but it accommodated a very few women in this profession. Next was the industry of CSP Services where earnings per person were higher than those from any other industry except that from trade. The industry of manufacturing was important both for backward and the scheduled caste women as the industry of agriculture was for the general caste woman. The implications of the study are that the industries of CSP services & Manufacturing hold much scope for rural landless women. The income of the rural landless women may increase manifold if they are given vocational training. The provision of appropriate credit facilities in the area along with technical know-how may help set up small scale manufacturing industry in the sample area which will not raise their income only but will provide employment to other women in the area as well.

References

- Anonymous. 2004. National Industrial Classification (NIC), Government of India. *Central Statistical Organisation*, New Delhi.
- Haffis, S., Reddy, Y.R. and Ramakrishna, Y.S. 2005. Male-Female Differences in Agricultural productivity: A Decomposition. *Agricultural Situation in India*. **62** (7): 507-511.
- Lanzouw, P. and Shariff, A. 2004. Rural non-farm employment in India: Access, Incomes and Poverty Impact. *Economic and Political Weekly*. **39** (40): 4429-4446.
- Padhi, K. 2007. Agricultural labour in India-A close Look. *Orissa Review*. February-March: 23-28

YIELDS, COSTS AND RETURNS FROM HORTICULTURAL CROPS: EVIDENCE FROM FIELD SURVEY IN HARYANA

Usha Tuteja and Subhash Chandra*

Abstract

This paper aims to analyse the returns from four horticultural crops vis-à-vis non-horticultural crops during 2008-09. It also probes into employment generation through cultivation of these crops. This study was based on field survey data collected from three districts of Haryana. The main findings revealed that the gross returns per acre from garlic cultivation were found to be higher than other horticultural crops during this year and this was true for net returns as well. The selected horticultural crops generated higher employment in comparison to traditional crops. In particular, garlic generated highest employment per acre in terms of labour days. The net returns from kharif, Rabi and horticultural crops grown by the farmers indicated that the garlic followed by the flowers, aonla and guava were far superior crops in terms of profitability in comparison to the traditional crops like wheat and paddy on sampled farms in Haryana.

Introduction

The horticultural crops form a vital part of the Indian agriculture and shared about 30 per cent of total agricultural production in value terms. India is the world's second largest producer of fruits and vegetables. The cultivation and processing of these crops generate significant employment opportunities for the rural and peri-urban population and marketing channels create employment prospects for the urban poor, ensuring livelihood security. The horticultural sector including fruits, vegetables, condiments and spices with a share of about six per cent in the total cropped area contributed highest (32 per cent) to the total value of crop production in TE 2004-05. Between 1995-96 and 2004-05, gross value of fruits and vegetables grew at an annual rate of 5.6 per cent, higher than growth of any other crop. However, growth in their contribution was one of the lowest (2.9 per cent) between 1981-82 and 1995-96 (Birthal *et al.*, 2008). Indian agriculture is dominated by small

* Acting Director and Research Investigator, Agro Economics Research Centre, Delhi University, New Delhi-110007

and marginal farmers. According to the *Agricultural Census*, 2001, 81.9 per cent of holdings were less than or equal to 2 hectares and had an average size of 0.59 hectare. Although, horticulture has potential of higher returns from land, it is often devoted that farmers cultivating tiny pieces of land may not diversify towards these crops due to numerous constraints in production, marketing and price risks associated with these crops. Among horticultural crops, vegetables are more pronounced on small farms, while fruits, condiments and spices occupy a higher share on large farms. These differences are on the expected lines. Vegetables generate quick returns; require less capital and more labour, which match resource endowments of the small farmers. Since, the fruits, condiments and spices require higher initial capital and have a long gestation period these do not suit to small farmers who are capital constrained. Therefore, the small farmers generally diversify towards vegetables because of surplus labour and liquidity constraint (Birthal *et al.*, 2008). Horticulture can be promoted as a means of agro-diversification for the second *green revolution* in India, providing the much-needed impetus to the growth of agricultural sector, through increase in trade, income and employment. The Indian agriculture is diversifying towards production of high value commodities along with increasing role of small holding farmers (Mittal, 2009). The horticulture crops constituting fruits, nuts and vegetables including potato, tuber and mushroom, ornamental plants including cut flowers, spices, and plantation crops have become a key driver of economic development in many states of the country and contribute significantly to the GDP of agriculture. In literature, importance of horticulture in improving productivity of land, economic conditions of the farmers and entrepreneurs, enhancing exports and, above all, providing nutritional security to common masses, is widely acknowledged (Chopra, 2010).

The value productivity per hectare of horticultural crops has been estimated higher than cereals, pulses, oilseeds, sugarcane and cotton. The differential in per hectare value of output was more than ` 0.50 lakhs. The next two decades witnessed increase in productivity of all crop groups but absolute gains were much larger for horticultural crops. The horticultural crops covered 20.7 million hectares of area and produced 214.72 million tonnes of output in 2008-09, accounting for 8.5 per cent of gross cropped area of the country.

During the past two decades, area, production, productivity, availability and exports of horticulture crops have increased manifolds, which provided ample opportunities for utilization of wastelands, employment generation and effective land use planning. Diversification through horticultural crops has been recognized as one of the options for improving land use. If figures of production of various crops

are compared with base period (1990-91), the horticultural crops have grown much faster. The contribution of horticulture to GDP of agriculture, which was only 0.58 per cent during 1952-53, with total production of 25 million tonnes increased to 18 per cent from six percent area in 1991-92 and subsequently to 30.4 per cent of agriculture GDP from nine percent area in 2007-2008 and crop diversification through horticulture crops has also improved employment opportunities which increased sharply between 2000-2010.

India emerged as second largest producer of fruits (68.5 million tonnes) contributing 11.2 per cent share in global fruit production. India occupies first place in the production of mango, banana, papaya, pomegranate, sapota and aonla. The production and productivity of banana and sapota is the highest in the world.

Agricultural economy of Haryana is food grains based with 66.7 per cent of gross cropped area (GCA) under their cultivation. Wheat followed by paddy has been observed as the most important cereal crops with 36.7 and 15.9 per cent of GCA in the state during the triennium ending 2008-09, respectively. In addition, mustard and cotton are also grown on sizeable proportion (10.4 and 8.9 per cent) of GCA. It is essential to mention that area under pulses became as low as 2.7 per cent of GCA during the reference period. However, only 1.11 per cent of GCA was devoted to horticultural crops in Haryana in 2007-08.

Although, agro climatic conditions of Haryana are suitable for growing horticultural crops, progress of horticulture in terms of area devoted has been rather slow and does not commensurate with the availability of excellent natural and efficient human resources. In fact, higher yields and better returns through assured marketing from wheat-rice cropping system has been one of the major reasons for reluctance of the farmers to shift to fruit crops which have a long gestation period. In the past, public policy, at state and central levels has paid inadequate attention to the development of horticultural crops. Now, policy makers have realized the growth potential of horticultural crops and proactive steps have been undertaken by the Government through implementation of programmes like the National Horticultural Mission (Singh and Mathur, 2008).

Recently, the government of Haryana has been making concerted efforts to diversify agriculture through popularizing horticultural crops. These crops are being promoted because a variety of fruits and vegetables can be grown in different agro-climatic regions of the state with the assistance of Central Government. Keeping in view the urgency of crop diversification and potential of horticultural crops in enhancing income of the farmers, this paper was planned and specific objectives of this research investigation were:

- i. to analyse economics of selected horticultural crops vis-à-vis non-horticultural crops,
- ii. to work out the net returns from related horticultural crops vis-à-vis other important crops and
- iii. to compare the generation of employment through cultivation of horticultural crops with other important crops.

Methodology

This paper is based on primary data. In order to collect primary data, a field survey was conducted in three districts of Haryana namely Sirsa, Rohtak, and Hisar. For detailed investigation, 50 farmers growing kinnow, guava, aonla and garlic from each selected district were chosen for in-depth analysis. On the whole, 150 farmers constituted sample of the study. Further, in each of the selected district, 25 farmers from nearby villages and 25 farmers from far off villages were selected. An effort was made to cover farmers from all categories such as small, marginal, OBC and SC farmers.

The returns from these four selected horticultural crops vis-à-vis other important non-horticultural crops such as paddy, bajra, vegetables, cotton and moong, in kharif season, wheat, mustard, vegetables and gram in *rabi* season have been compared. The costs considered for horticultural crops included variable as well as fixed costs. The variable costs constituted preparatory tillage, manure and fertilizers, transplanting and gap filling, irrigation, weeding and intercultural operation, topping/pruning, plant protection, harvesting and collection, grading, storage, transport and packing, cost of labour and interest on working capital. Under the fixed costs, planting material, initial preparatory tillage cost, cost of supporting material and irrigation set up considered these costs incurred at the time of establishing a fruit orchard were spread over the gestation period. In the case of other important crops, material and labour costs were considered appropriate for the estimation of the net returns. These costs constituted purchased and imputed value of inputs including labour use in cultivation of a particular crop. The profitability being a catalytic factor in increased production of agricultural commodities, therefore, it was proposed to examine the same for the horticultural crops and other important crops grown on the sampled farms in Haryana during 2008-09. The gross returns for horticultural crops were computed on the basis of value of the main product while by product were added in the case of other crops. The net returns for each crop were worked out by subtracting costs from gross returns. It may be

mentioned here that net returns and profitability are used interchangeably in this analysis.

Results and Discussion

The results of profitability of kinnow, guava, aonla and garlic vis-à-vis other important crops on the sampled farm households have been presented in this section.

Yield, costs and net returns from selected horticultural crops

Kinnow

The kinnow is a variety of citrus fruit cultivated extensively in India and to some extent in Haryana. With the availability of technology from the Agricultural Universities and the State Departments of Horticulture, farmers are getting incentives to grow kinnow on larger scale and thereby, earning profits better than the traditional crops. The acreage under kinnow has been expanding rapidly in Haryana during the last couple of years.

The information on gross returns and net returns from Kinnow cultivation on the sampled farms for the have been presented in Table 1.

Table 1: Yield, costs and net returns from cultivation of kinnow on sample farms in Haryana
(C Acre^{-1})

Farm Size	Small	Medium	Large	overall
Cost components (Percent)				
Preparatory tillage	11.41	11.10	12.78	12.67
Manure and fertilizer	23.23	19.10	18.94	19.01
Transplanting and gap filling	0.32	0.09	0.12	0.12
Irrigation, canal, electricity and diesel	10.19	10.98	11.58	11.53
Weeding and intercultural operation	8.55	9.64	6.13	6.34
Topping/ pruning	6.39	4.19	4.19	4.22
Plant protection, pesticides, etc.	11.53	19.01	13.79	14.02
Harvesting and collection	1.81	1.75	0.82	0.88
Grading, storage, transport and packing	-	0.68	0.84	0.82
Interest on working capital	6.10	6.15	5.56	5.59
Labour cost	13.70	11.38	10.21	10.32
Variable cost (VC)	93.22	94.06	84.95	85.51
Fixed cost *	6.78	5.94	15.05	14.49
Total cost (VC + Fixed cost)	9217.15	10223.10	9036.60	9090.34
Gross returns (GR)	25111.11	24982.14	21922.06	22100.78
Net returns (GR-Total cost)	15893.96	14759.05	12885.46	13010.44
Net returns over VC (GR- VC)	16519.11	15366.61	14245.80	14327.51
Average area planted (acre)	1.80	2.80	7.63	6.81
Yield q acre⁻¹	22.56	22.21	19.36	19.53

Source: Field Survey

Cost components are percentages to the total cost.

**Included the planting material, field preparation cost, supporting material and irrigation setup (amortized over the life time)*

It may be noticed that gross returns per acre from kinnow cultivation on these farms during this year were `22100 at the overall level. Significant differences were observed across various categories of farmers.

The yield rate per acre from kinnow cultivation was found highest in small category households and therefore, gross returns were also observed higher in this category in comparison to other categories of farm households. It is expected that assistance received under the national Horticultural Mission (NHM) has reduced costs of farmers and helped them in reaping higher net returns per acre from kinnow cultivation. The net returns from kinnow cultivation at variable cost were `14327 at the aggregate level. Class variations were also noticed for net returns per acre and small farmers reaped higher net returns than other categories of farm households. In fact, scenario did not change after including fixed costs too.

The cost of manure and fertilizers followed by the plant protection measures were the most important components in this case besides preparatory tillage and irrigation at the aggregate level. The proportion of cost components in variable and fixed costs varied across different farm size categories but manure and fertilizers together dominated in each case.

Guava

The plants begin bearing at an early age of 2-3 years but they attain full bearing capacity at the age of 8-10 years. The yield of a plant depends on its age and cultural practices. Guava is a minor fruit crop grown in Haryana. Table 2 suggests that gross and net returns per acre by cultivating guava on sampled farms during 2008-09 were `27840 at the aggregate level. The corresponding figures for marginal, small, medium and large farmers were `45333 and `33000, `37215 and `23272, respectively. These were observed lowest on large farms. The same pattern was noticed for net returns per acre at the variable costs and marginal farmers were observed as greater beneficiary in comparison to other categories. After including fixed costs, the pattern did not change.

Like kinnow, manure and fertilizers together constituted higher share of total costs at the overall level and in individual categories of farmers. In order of importance, second and third components were plant protection measures and preparatory tillage which formed at least 6 per cent of this cost in each category. In addition, labour cost constituted 5.83 per cent of the total costs at the aggregate level. In none of the case, it was less than 5 per cent. Fixed costs were found significant as these were observed more than 40 per cent in each case. The highest share of fixed costs was found in large farm size category since it crossed 54 per cent level.

Table 2: Yield, costs and net returns from cultivation of guava on sample farms in Haryana

Farm size	Marginal	Small	Medium	Large	Overall
(Acre ⁻¹)					
Cost components (Percent)					
Preparatory tillage	6.23	6.41	7.83	6.68	6.80
Manure and fertilizers	14.86	10.29	11.04	11.42	11.46
Transplanting and gap filling	0.02	0.03	0.03	0.03	0.03
Irrigation, canal, electricity and diesel	5.38	5.51	5.49	5.76	5.65
Weeding and inter-culture operations	5.40	3.27	3.47	3.27	3.47
Topping/ pruning	1.20	0.99	1.54	1.17	1.21
Plant protection, pesticides, etc.	6.99	6.30	7.07	7.90	7.45
Harvesting and collection	2.33	1.19	1.66	1.02	1.25
Grading, storage, transport and packing	1.86	0.87	0.51	0.52	0.67
Interest on working capital	3.67	2.90	3.14	3.02	3.07
Labour cost	8.06	6.55	6.21	5.27	5.83
Variable cost	56.02	44.30	47.99	46.05	46.90
Fixed cost* a) Material cost	31.74	45.81	39.36	41.17	40.81
b) Labour cost	12.24	9.89	12.65	12.78	12.29
Total Cost	19721.27	22940.76	20889.93	15455.33	17350.55
Gross Returns (GR)	45333.33	33000.00	37215.71	23272.39	27840.71
Net Returns (GR-Total cost)	25612.06	10059.24	16325.79	7817.06	10490.16
Net Returns (GR-variable cost)	34286.14	22836.52	27190.07	16155.12	19703.83
Average Area Planted (acre)	0.96	1.83	1.4	3.53	2.35
Yield q acre⁻¹	29.78	20.64	32.93	20.07	22.62

Source: Field Survey

Cost components are percentages to the total cost.

*Included planting material, field preparation cost, supporting material and irrigation setup (amortized over the life time)

Aonla

Aonla is an important fruit crop indigenous to Indian sub-continent, which can be grown successfully in dry and neglected regions. The area under aonla has been expanding rapidly in the last couple of years. The growing popularity for alternate medicines, health foods and herbal products are responsible for enhancing the requirement for aonla fruit. This fruit is highly nutritive with a great medicinal value. In addition, it is the richest source of Vitamin-C.

The demand for aonla is increasing both internally and externally. Its popularity as anti disease agent would boost demand further. The increasing knowledge about its medicinal qualities would increase demand in future and these developments can benefit farmers if proper strategy to enhance yield, post harvest technology and processing is evolved. The story of gross returns and net returns from aonla cultivation on sampled farms in selected districts during 2008-09 is different. Its productivity was found higher than kinnow and guava. Gross returns per acre from its cultivation were observed ` 36523 at the aggregate level. Unexpectedly, there was a huge gap in gross returns per acre from aonla cultivation on medium and

large farms. After subtracting variable costs, farmers reaped ₹ 29853 per acre during 2008-09. After adding the fixed costs, net returns per acre became less than half. In case of aonla, variable costs constituted around 29 per cent of the total cost and remaining 71 per cent were the fixed costs. Out of variable costs, manure and fertilizers together and preparatory tillage constituted more than 10 per cent in each case (Table 3).

Table 3: Yield, costs and net returns from cultivation of aonla on sample farms in Haryana

Farm Size	₹ (Acre ⁻¹)		
	Medium	Large	Overall
Cost components (Percent)			
Preparatory tillage	14.51	5.60	5.72
Manure and fertilizers	13.23	6.31	6.41
Transplanting and gap filling	0.06	0.01	0.02
Irrigation, canal, electricity and diesel	11.44	3.46	3.57
Weeding and inter-culture operations	3.49	2.03	2.05
Plant protection, pesticides etc.	6.05	3.72	3.75
Harvesting and collection	-	1.28	1.27
Grading, storage, transport and packing	-	0.85	0.84
Interest on working capital	4.01	1.89	1.92
Labour cost	8.51	3.69	3.76
Variable cost	61.30	28.84	29.30
Fixed cost* a) Material cost	32.00	64.11	63.66
b) Labour cost	6.70	7.04	7.04
Total Cost (Variable + Fixed)	8957.33	23276.65	22765.11
Gross Returns (GR)	16666.67	37259.26	36523.81
Net Returns (GR-Total cost)	7709.33	13982.60	13758.70
Net Returns (GR-variable cost)	11176.00	30545.57	29853.94
Yield q acre⁻¹	15.33	24.57	24.24
Average area planted (acres)	0.75	6.75	5.25

* Planting material, field preparation cost, supporting material and irrigation setup) (amortized over the life time)
Cost components are percentages to the total cost.

Garlic

Garlic is recognized all over the world as a valuable condiment for food and a remedy for various ailments and physiological disorders. The raw garlic is also used in manufacturing of garlic powder, garlic salt, garlic vinegar, garlic cheese, potato chips, garlic bread, etc. Garlic has since long been cultivated throughout India as an important minor spice or condiment crop. Moreover, area under garlic in India has been increasing remarkably over the years with higher fluctuations.

Garlic is a short duration crop and land is occupied only for six months. The gross returns and net returns from garlic cultivation on sampled farms in selected three districts during 2008-09 show that gross returns per acre from garlic cultivation were ₹ 68480 at the aggregate level. It is essential to mention that this is the highest

returns reaped by the farmers from growing selected horticultural crops. After subtracting variable costs, from gross returns, net returns per acre from garlic cultivation were computed ` 40612 at the overall level. The comparable figures for marginal, small, medium and large farmers were ` 36350, ` 29744, ` 43261 and ` 41345, respectively. Clearly, medium farmers reaped higher net returns in comparison to other categories. The transplanting followed harvesting, manure and fertilizers were the major cost components in garlic cultivation (Table 4).

Table 4: Yield, costs and net returns from cultivation of garlic on sample farms in Haryana

	(` Acre ⁻¹)				
Particulars	Marginal	Small	Medium	Large	Overall
Cost components (Percent)					
Preparatory tillage	9.56	7.01	7.78	9.97	9.03
Manure and fertilizers	5.74	10.12	13.16	11.16	11.31
Transplanting and gap filling	22.94	19.46	16.75	18.88	18.58
Irrigation, canal, electricity and diesel	11.47	10.70	7.85	5.43	6.97
Weeding and inter-culture operations	7.65	5.64	6.88	10.92	9.08
Plant protection, pesticides, etc.	1.91	6.81	6.73	6.55	6.38
Harvesting and collection	15.30	17.52	17.95	13.38	15.17
Grading, storage, transport and packing	5.74	2.34	4.26	5.46	4.82
Interest on working capital	1.72	1.72	1.72	1.72	1.72
Labour cost	17.97	18.68	16.90	16.53	16.94
Variable cost	26150.00	34256.00	26739.00	27645.00	27867.57
Gross Returns (GR)	62500.00	64000.00	70000.00	68990.00	68480.00
Net returns (GR-Variable cost)	36350.00	29744.00	43261.00	41345.00	40612.43
Yield q acre-1	25.00	30.00	28.00	24.70	26.11
Average area planted (acre)	1.00	0.50	0.63	0.83	0.73

Cost components are percentages to the total cost.

Net returns from horticultural crops vis-à-vis non-horticultural crops

In order to make a broad comparison of selected horticultural crops vis-à-vis non-horticultural crops, the information is presented in Table 5. The results show that net returns from cultivation of garlic followed by flower cultivation were found higher in comparison to main crops of Haryana such as paddy, cotton and bajra in kharif season and wheat, mustard, and vegetables in Rabi season. Another horticultural crop, aonla also provided net returns worth ` 30345 per acre at the aggregate level. Guava indicated ` 25660 per acre. Kinnow exhibits lowest returns

from its cultivation because these are the initial years of fruit bearing and therefore, yield rates were found lower in comparison to full bearing stage.

Thus, among non-horticultural crops cotton and paddy were found relatively profitable but net returns in each case were noticed lower than selected horticultural crops except kinnow which showed lower profitability due to above cited reason. Farm size variations were found significant in net returns obtained from the cultivation of each and every crop. Moreover, any arithmetic relationship in farm size and net returns could not be ascertained.

Table 5: Net returns from horticultural and non-horticultural crops

Name of the crop	(` Acre ⁻¹)				
	Marginal	Small	Medium	Large	Total
Kharif Crops					
Paddy	-	12583	10852	12762	12499
Bajra	2750	4109	2649	3083	3063
Vegetables	9665	14267	8972	6631	7476
Cotton	-	15231	13288	14419	14383
Moong	-	-	14000	5303	5352
Flower	19000	-	62500	-	40750
Rabi Crops					
Wheat	7417	6455	7027	5377	5558
Mustard	6000	10075	7022	7068	7086
Vegetables	9250	23013	7141	7190	8011
Gram	-	-	-	6263	6263
Horticultural Crops					
Garlic	34700	32300	50050	41165	42289
Kinnow	-	31222	16670	11852	12348
Guava	35022	23917	25901	25282	25660
Aonla	-	-	10333	31084	30343

Use of human labour

In recent years, there has been a great deal of interest among policy makers in the role of horticultural crops as principal means of agricultural diversification. Conditions for expanding area and production of horticultural crops are favourable in countries like India. This is partly because horticultural crops in general are labour intensive. Countries with abundant labour in comparison to capital enjoy a comparative advantage in labour intensive horticultural crops as against crops like cereals which require more land in relation to labour and other inputs for efficient production.

The perusal of Table 6 shows that garlic generated highest employment per acre in terms of labour days. Among non-horticultural crops, cotton, flowers and moong generated at least 20 days employment. Vegetables also generated 16 days per acre employment in kharif season and 14 days per acre employment during the Rabi season.

Table 6: Use of human labour in crop production

Name of the crop	(Man days Acre ⁻¹)				
	Marginal	Small	Medium	Large	Total
Kharif Crops					
Paddy	0	11	18	14	15
Bajra	14	5	10	6	6
Vegetable	13	40	17	14	16
Cotton	0	32	24	22	22
Moong	0	0	20	8	8
Gwar	0	0	20	7	7
Jowar	7	4	6	8	7
Flower	27	0	17	0	22
Arhar	0	2	10	27	17
Rabi Crops					
Wheat	9	8	11	11	11
Mustard	17	9	13	11	11
Vegetable	16	25	13	14	14
Barseem	0	3	3	7	6
Jowar	0	0	6	8	7
Gram	0	0	0	10	10
Barley	0	0	0	7	7
Horticultural Crops					
Garlic	100	148	65	79	84
Kinnow	0	21	16	15	15
Guava	29	23	22	16	18
Aonla	0	0	13	14	14

It is essential to gauge activity wise use of human labour in cultivation of horticultural crops grown by the sampled farmers. We have included recurring as well as fixed activities under taken by the farmers to arrive at these calculations. The perusal of Table 7 indicates that around seven man days per acre were used for pit making followed by weeding and inter-culture operations. Further, around two man days per acre were utilized in each activity related to topping/pruning, plant protection and pesticides application, seedling and wiring at the overall level. The average use of labour was around 29 man days per acre. But, marginal farmers

utilized higher number of man days per acre in cultivation of horticultural crops in comparison to other categories of the farmers.

Table 7: Use of human labour by activities in horticultural crops on sampled farms

Farm Size	(Man days Acre ⁻¹)				
	Marginal	Small	Medium	Large	Total
Recurring activities undertaken every year					
Preparatory tillage	2.22	1.92	1.36	0.93	0.99
Manure and fertilizers	2.52	2.42	1.76	1.63	1.67
Transplanting and Gap filling	0.00	0.00	0.00	0.01	0.01
Irrigation, electricity and diesel	2.27	2.27	1.57	1.18	1.24
Weeding and inter-culture operation	6.91	4.97	5.65	3.45	3.65
Topping/ Pruning	1.58	2.60	2.53	2.29	2.31
Plant protection, pesticides, etc.	4.30	2.50	2.72	1.92	2.00
Harvesting and collection	3.06	1.50	1.51	0.63	0.73
Grading, storage, transport and packing	1.83	0.53	0.84	0.43	0.47
Activities undertaken in plantation					
<i>(a) Planting material like seedling, nursery, etc.</i>					
Seedling	3.46	1.83	2.12	2.48	2.45
<i>(b) Field preparation</i>					
Digging	2.07	2.62	2.08	1.53	1.59
Pit making	6.12	6.53	7.04	7.19	7.15
Fencing	0.00	0.00	0.00	0.00	0.00
<i>(c) Supporting material</i>					
Wiring	2.27	1.67	1.83	2.33	2.28
Iron angles	0.99	1.00	0.26	0.24	0.27
Bamboo	1.19	0.00	0.03	0.02	0.03
<i>(d) Laying down of permanent irrigation</i>					
Pipeline	0.00	0.13	0.00	1.48	1.35
Instruments	0.00	0.03	0.00	0.58	0.53
Gross Total	40.79	32.52	31.3	28.33	28.71

To conclude, horticultural crops such as vegetable and fruit crops show greater potential of generating employment as compared to cereals and other food grain crops. Commercial crops like cotton too generate relatively higher employment in comparison to several other crops. Among horticultural crops, generation of employment depends on the type of fruit and vegetable crops. An examination of activity wise use of human labour in cultivation of selected horticultural crops revealed that marginal farmers used more than average number of labour days in growing these crops. Major activities consuming higher share of human labour were pit making, seedling, weeding and plant protection measures irrespective of farm size.

Conclusions

The results showed that gross return per acre from garlic cultivation were higher than other horticultural crops during the study year and was true for net returns as well. A wide variation was observed when net returns were calculated at total cost after including fixed costs incurred by the growers. Among fruit crops, kinnow, guava and aonla, net returns from latter were found higher than first two crops. In the case of kinnow, a positive relationship could be ascertained between farm size and returns. However, a mixed scenario emerged in case of remaining two horticultural crops. Therefore, any relationship between returns and farm size could not be arithmetically ascertained.

A comparison of returns from cultivation of selected horticultural crops with other important crops during the *kharif* season has exhibited that flowers and cotton were found superior than paddy in terms of net returns. The economics of moong, a minor pulse crop grown on sampled farms was also worked out and profitability was compared vis-à-vis other crops such as bajra, cotton and paddy. This pulse crop provided lower net returns per acre in comparison to above mentioned crops. It was observed that vegetables were observed superior crop than wheat and mustard in terms of returns during rabi season. An analysis of net returns from kharif, rabi and horticultural crops grown by the farmers indicated that garlic followed by flowers, aonla and guava were far superior crops in terms of profitability in comparison to non-horticultural crops like wheat and paddy on sampled farms in Haryana. The selected horticultural crops generated higher employment in comparison to traditional crops. In particular, garlic generated highest employment per acre in terms of labour days. Among various categories of farmers, marginal farmers used more than average number of labour days in growing these crops. Further, weeding and inter cultural operations were found most labour intensive and therefore, higher proportion of labour days was used for these activities.

References

- Birthal, P.S., Joshi, P.K., Chauhan, S. and Singh, H. 2008. Can Horticulture Revitalize Agricultural Growth? *Indian Journal of Agricultural Economics*. 63 (3): 310-321
- Chand, R., Raju, S.S. and Pandey, L.M. 2008. Progress and potential of Horticulture in India. *Indian Journal of Agricultural Economics*. 63 (3): 299-309
- Kumar, P. and Sharma, A. 2006. Perennial Crop Supply Response Functions: The case of Indian Rubber, Tea and Coffee. *Indian Journal of Agricultural Economics*. 61 (4): 630-646.
- Mittal, S. 2009. Feasibility check for Diversification towards horticultural Production. *Agricultural Economics Research Review*. 22 (1):81-86.

- Singh, H.P. 2009. Conference keynote paper on Triggering Agricultural Development Through Horticultural Crop. *Indian Journal of Agricultural Economics*. 64 (1): 15-39.
- Singh, M. and Mathur, V.C. 2008. Structural Changes in Horticulture in India: Retrospect and prospect for 11th Five Year Plan. *Indian Journal of Agricultural Economics*. 63 (3): 332-48.
- Singh, R., Patel, V.P. and Singh, S.K. 2006. Current Status and Future Thrust of Temperate Fruits in India. *Temperate Horticulture: Current scenario*. (edited). Kishore D.K., Sharma Satish K., and Pramanick K.K. New India Publishing Agency, New Delhi.

PUBLIC INVESTMENT IN FARM SECTOR OF PUNJAB- AN IMPACT ANALYSIS

Amanpreet Kaur, J.L.Sharma and S.S.Chahal*

Abstract

The present study was conducted to assess the impact of public investment in agricultural research on productivity of crops and enterprises in Punjab. In order to achieve the stipulated objectives of the study the data on research expenditure and productivity of crops and enterprises were compiled from Center for Monitoring Indian Economy Reports, Statistical Abstract of Punjab, and from various departments of Punjab Agricultural University for the period 1985-86 to 2009-10. The tabular and functional analyses were used to analyse the data. Overview of growth analysis of research expenditure and productivity shows that for all the crops except oilseed, pulses and maize the research expenditure and productivity shows positive relationship. This calls for promotion in the investment to augment the production for realizing benefits of increased output. The impact of public sector investment on productivity of crops/enterprises was positive but with lapse of time. Lag effect of research investment on productivity implies reduction in food grain productivity. The study pointed out the need for sustained public investment as a means to raise the productivity of crops and allied enterprises such as mushroom farming, beekeeping, etc. The findings suggested that the government should increase the allocation of funds to farm sector research in order to improve research efficiency.

Introduction

The public investment in agriculture is a pre-requisite for the growth of agriculture and is vital for sustained growth of the sector in order to meet the increasing demand of food Grains. The productive base of the farm sector needs to be enlarged through direct public investment in irrigation schemes, soil and water conservation works, land reclamation, etc. Additional boost in agricultural production

* Ph.D. Student, Professor of Economics (Retired) and Senior Economist (Marketing) respectively, Department of Economics and Sociology, Punjab Agricultural University, Ludhiana

Paper is based on M.Sc. Thesis entitled *Analysis of Public Sector Investment in Agricultural Research in Punjab*, submitted by the first author and approved by the Punjab Agricultural University, Ludhiana in 2011.

to the levels needed to feed an ever expanding world population will require sharp increase in public investment in research and development and widespread adoption of new technologies, farming techniques and crop varieties. In this view, agriculture research is the most powerful instrument for the development of improved production technology. In India, public research dominates the agricultural research system.

Thus, it is imperative for Government of India to step up its research activities to help and solve agricultural production problems of the country in general and food production in particular. The public investments need to be stepped up in regions which although relatively backward but have a high potential for agricultural growth as productivity levels in the Green Revolution areas have already reached the plateau (Nath, 1998). The attention should be focused toward developing a system that would give research thrust to bring a balance between the food security, management of natural resources, etc. Importance should be given to the identified priority areas of short duration varieties, quality seed and developing crops with more protein and micronutrient content. Moreover, sufficient resources should be allocated to agriculture research and education to facilitate a rapid increase in agricultural productivity.

In this view, public investment is the most important single factor in the growth process especially in the case of Punjab agriculture where average size of farm is small and large numbers of small farmers depend upon public investment for infrastructure development and other requirements such as credit and subsidies (Pal, 2008). Thus, it is important for the policy makers and planners to analyse public sector investment in agricultural research and various type and levels of investments contributing to the productivity in Punjab agriculture. The knowledge of distribution will help to judge the rationality of the investment made. In the backdrop of this, the present study is an attempt to examine the impact of public sector investment on growth and productivity of the crops and enterprises in the Punjab state.

Methodology

In order to achieve the stipulated objectives of the study, the secondary data were used and compiled from Centre for Monitoring Indian Economy Reports, Statistical Abstract of Punjab, and publications of various departments of Punjab Agricultural University for the period 1985-86 to 2009-10. In order to fulfill the objectives of the study, data on crops like wheat, rice, maize, cotton, sugarcane, oilseeds and pulses were collected. The cereals including wheat, rice and maize were included for detailed study. Similarly, mushroom farming and bee-keeping were the

enterprises considered for detailed analysis only due to non-availability of data on other enterprises.

Optimum Sub-periods

For the purpose of growth analysis the entire study period 1985-86 to 2009-10 was divided into sub- periods by construction of strata by following Cumulative Cube Root Rule (Singh, 1975) to obtain approximately optimum strata boundaries. To obtained frequencies, percentage of expenditure to total was obtained. Then cube root of frequencies for each ‘K’ classes was obtained. Further cumulative total of the cube root of frequencies of each ‘K’ was obtained. Let T denote the cumulative total for the Kth class. For construction of three strata, value of $X=X_1$ was obtained, which corresponds to the value $T/3$ in the cumulative cube root frequency column. This process was repeated to obtained $X=X_1$ (I= 1, 2). The value (X_1, X_2) so obtained defined three strata with boundaries $(< X_1)$, $(X_1$ to $X_2)$ and $(X_2$ to $X_2<)$.By following the above procedure cut-off year was found for different expenditure.

The time horizon of the study was divided in the three periods, Period I: 1985-86 to 1993-94, Period II: 1994-95 to 2000-01 and Period III: 2001-02 to 2009-10 to examine the public sector investment in agricultural research and education. In order to examine the crop-wise research expenditure by Punjab Agricultural University (PAU) the time horizon was divided into periods, Period I (1985-86 to 1992-93), Period II (1993-94 to 2002-03) and Period III (2003-04 to 2009-10). These three sub-periods reflect distinct patterns in agriculture investment.

Compound Growth Rate

The growth rate in research investment was computed for the entire study period and three sub-periods separately using equation (1):

$$\log Y_t = \log \alpha + X \log \beta + u_t \dots\dots\dots(1)$$

where, Y_t = Expenditure on agriculture in the year t,

α = Constant-term,

β = Regression parameter,

u_t = Residual term, and

X = Relevant year.

$$\text{Compound Growth Rate (CGR)} = [\text{Antilog}(\log \beta)-1] \times 100 \dots\dots\dots (2)$$

Significance of co-efficient was tested by t-Statistic and significance of the model was tested in term of goodness of fit.

Functional Analysis

To study the effect of public sector investment on productivity and growth of different crops and enterprises, the time horizon was divided into two sub-periods,

Period I: 1985-86 to 1994-95 and Period II: 1995-96 to 2009-2010. Distributed Lag Model was employed for the analysis. In this approach productivity was regressed on research investment. The productivity of food grains given in of Statistical Abstract of Punjab for period (1985-86 to 2009-10) was considered. The time issues were addressed by forming lag of research investments by PAU using Almon's Lag Scheme. The functions with different lag periods were tried and one with highest R^2 was considered to be the most appropriate. The following investment model was applied for the analysis.

$$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + u_t \dots\dots\dots (3)$$

Where, Y_t = Productivity of crop/enterprises,

α = Constant-term,

β_i = Regression parameter, where $i=1, 2, \dots n$.

u_t = Residual-term, and

X_t = Research expenditure by PAU.

Further, β_i were approximated by a second degree polynomial as shown by equation (5):

We express the β_i in terms of the a 's

$$\beta_i = a_0 + a_1 i + a_2 i^2 \dots\dots\dots (4)$$

Substituting (4) into (3), we obtain

$$Y_t = \alpha + a_0 Z_{0t} + a_1 Z_{1t} + a_2 Z_{2t} + u_t \dots\dots\dots (5)$$

$$\text{Defining, } Z_{0t} = \sum_{i=0}^2 X_t = X_t + X_{t-1} + X_{t-2}$$

$$Z_{1t} = \sum_{i=0}^2 i X_t = X_{t-1} + 2X_{t-2}$$

$$Z_{2t} = \sum_{i=0}^2 i^2 X_t = X_{t-1} + 4X_{t-2}$$

From the estimated a 's, we easily obtained the original β_i

$$\hat{\beta}_0 = \hat{a}_0$$

$$\hat{\beta}_1 = (\hat{a}_0 + \hat{a}_1 + \hat{a}_2)$$

$$\hat{\beta}_2 = (\hat{a}_0 + 2\hat{a}_1 + 4\hat{a}_2)$$

This model was fitted for each period. Significance of co-efficient was tested by t-Statistic and significance of the model was tested by F-Statistic. Independent variables were tested for their stochastic independence.

Results and Discussion

Impact of Public Sector Investment on Growth and Productivity

The investment requirement of the economy rises when it follows a high growth trajectory, as large investment are needed to sustain the existing levels of growth. The investments being pivotal for accelerating growth by raising the productive capacity, investment and productivity have been considered simultaneously in this section.

Growth Analysis

Research expenditure by the Punjab Government and productivity of crops

The perusal of Table 1 reveals that research expenditure grew at 3.29 per cent per annum and productivity of crops grew by 3.26 per cent per annum during Period I and CGRs were statistically significant. The research expenditure showed highest significant growth at 8.03 per cent per annum during Period II, when crop productivity was estimated to be 2.49 per cent per annum. In Punjab, the productivity of major crops has already reached the plateau, thus, to sustain the level of productivity and to develop cost efficient technologies the pace of research expenditure was increased to more than twice in Period II. During Period III, CGRs of research expenditure and productivity were statistically significant, but growth rate declined to 2.04 per cent per annum in the case of research expenditure and 1.49 per cent per annum in crop productivity. Thus, it could be concluded that there is a need to increase research funding by the state government to enhance crop productivity for meeting the increased demand of food grains.

Table 1: Growth rate of research expenditure by the Punjab Government and crop productivity: 1985-86 to 2009-10

Period	Research expenditure	Crop productivity
Period-I (1985-86 to 1993-94)	3.29** (2.99)	3.26** (0.46)
Period-II (1994-95 to 2000-01)	8.03** (2.70)	2.49** (0.77)
Period-III (2001-02 to 2009-10)	2.04** (2.08)	1.49** (0.72)

Figures in parentheses are standard errors

*** Significant at 5 per cent level*

Research expenditure by PAU vis-à-vis productivity of crops

The results presented in Table 2 revealed that during Period-I the growth of

research expenditure on maize had highest (4.15 per cent per annum) which was followed by wheat, cotton, and pulses, whereas productivity of oilseeds showed highest significant growth of 10.71 per cent per annum, followed by maize and, wheat. In the case of rice, research expenditure showed a significant but negative growth whereas its productivity depicted the growth by 0.98 per cent per annum, which was statistically significant. Similarly, oilseeds research expenditure show significant negative growth and productivity show significant growth. In the case of sugarcane, both research expenditure and productivity showed significant negative growths during Period I.

Table 2: Growth rate of research expenditure by PAU and productivity of crops

Crops	Research expenditure			Crop productivity		
	Period I	Period II	Period III	Period I	Period II	Period III
Wheat	3.29** (3.08)	17.00 ^{NS} (4.83)	2.79** (3.19)	2.39** (0.62)	1.77** (0.19)	1.36** (0.85)
Rice	-7.76** (3.25)	8.18** (5.41)	39.63** (14.19)	0.98** (0.73)	1.34** (0.61)	1.51** (0.77)
Maize	4.15** (2.12)	20.58** (7.47)	-13.80** (3.09)	2.59** (1.97)	3.79** (2.19)	4.05** (2.64)
Pulses	1.89** (3.44)	16.21** (6.62)	-4.55** (8.17)	-0.28** (1.25)	-4.59** (1.06)	-0.37** (0.80)
Sugarcane	-18.41** (4.38)	34.65** (8.17)	0.33** (15.74)	-0.05** (0.54)	0.03** (0.81)	2.59** (1.22)
Oilseeds	-0.03** (4.01)	23.37* (3.35)	-8.25** (2.19)	10.71* (1.95)	-1.01** (0.98)	0.58** (1.36)
Cotton	2.11** (1.79)	16.51** (6.81)	2.15** (9.92)	0.98** (1.31)	1.39** (5.8)	4.34** (3.73)

Figure in parentheses are standard errors.

***and*Significance at 5 and 10 per cent respectively*

NS: Non-significant

During the Period II, research expenditure on all crops showed significant growth rates. Sugarcane had the highest significant growth (34.65 % per annum), followed by oilseeds, maize, wheat, cotton, pulses and cotton. In terms of crop productivity, maize depicted highest significant growth (3.79 % per annum), followed by wheat, cotton and rice. During this period research expenditure on pulses and oilseeds shows a significant growth whereas their productivity declined significantly.

During Period III, growth analysis of research expenditure reveals that rice

had the highest significant growth rate (39.63 % per annum), followed by wheat, cotton, and sugarcane. The growth analysis of crop productivity pointed out that cotton showed highest significant growth of 4.34 per cent per annum followed closely by maize, sugarcane, rice and wheat. Further, the results indicated that the research expenditure on maize and oilseed showed significant but negative growth whereas productivity exhibit significant growths. In the case of pulses, CGR of research expenditure and productivity shows significant but negative growth (Appendix-I).

An overview of growth analysis showed that research expenditure and productivity on wheat had declined overtime, whereas in the case of rice research expenditure and productivity had increased. In the case of maize, research expenditure had a significant growth during Period II, but it show negative growth in Period III, whereas productivity had increased over time. The research expenditure on pulses had a significant growth in Period II but this growth could not be maintained which slumped in Period III, on the other hand productivity on pulses exhibited negative growth in all the three periods. The research expenditure on sugarcane depicted a significant positive growth in last two periods, with a very high growth during Period II, which drastically dropped in Period III, whereas growth rate of productivity had shown improvement overtime and same was observed in the case of cotton. Further, in the case of oilseed, the research expenditure and productivity moved in an opposite direction in all the three periods. Thus, from the above discussion it can be concluded that for crops like oilseeds, maize and pulses the research expenditure and productivity moved in almost in the opposite direction. The possible causes for negative relationship between research expenditure and productivity was an inadequate amount of research expenditure incurred by Punjab Agricultural University on oilseeds, pluses and maize. This calls for the augmentation of investment for increased productivity and this in turn ensures better returns to the farm operators.

Functional analysis

In this section distributed lag model was employed to delineate the impact of research investment on productivity of crops/enterprises and impact of investment on agricultural GDP.

Research investment by the Punjab Government: 1985-86 to 2009-10

The results presented in the Table 3 reveal that research expenditure by Punjab Government during Period-I had a positive impact on crops productivity and its impact was highest in second year. Impact of research expenditure was positive on

productivity but decline gradually in Period-II. As productivity of food grain has reached its peak, to achieve the sustainability in productivity the research expenditure has been incurred by state government. The value of R^2 during Period-I and II came out to be 0.60 and 0.72 respectively and were significant statistically.

The perusal of Table 3 pointed out that during Period I research expenditure by Punjab Government exhibits positive impact on enterprise productivity, which gradually improved and showed its highest impact in second year. During Period II, research expenditure by Punjab Government had a negative impact in current year, thereafter showed a positive impact, indicating productivity response to research expenditure but with the lapse of one year. The value of R^2 during Period I and II comes out to be 0.60 and 0.58 respectively. The results reveal that research expenditure by Punjab Government has positive impact on agricultural GDP with highest impact with lag of two year. The value of R^2 comes out to be 0.67 which was statistically significant.

Table 3: Regression analysis of research investment by Punjab State Government

Particulars	Crops		Enterprises		Agricultural GDP
	Period I	Period II	Period I	Period II	Total period
Intercept	144.96** (59.63)	163.36** (30.92)	364.02** (87.35)	140.65** (37.06)	166.04** (249.51)
X_t	1.05** (2.11)	2.23** (1.62)	6.67** (3.69)	-10.55 ^{NS} (2.05)	29.84** (3.12)
X_{t-1}	1.97** (4.62)	1.65** (3.44)	12.36** (2.94)	5.40** (1.92)	23.79** (5.61)
X_{t-2}	3.83** (2.22)	0.59** (1.66)	23.13** (1.34)	8.49** (3.49)	32.00** (7.09)
R^2	0.60	0.72	0.60	0.58	0.67

Figure in parentheses are standard errors.

**** Significant at 5 per cent level**

NS: Non-significant

Research investment by the Punjab Agricultural University: 1985-86 to 1994-95

The results presented in Table 4 reveals that in the case of wheat, the value of R^2 comes out to be 0.60 and coefficients of research expenditure were significant at five per cent level. Further, the results pointed out that research expenditure on wheat had positive impact on its productivity with lag of one year and it improves gradually. The value of R^2 for rice was 0.49 and coefficient of research expenditure was significant at five percent level indicating that research expenditure on rice has

positive impact on productivity which had become stronger with time and which was highest in second year.

Table 4: Regression analysis of research investment by Punjab Agricultural University in respect of crops and enterprises (1985-86 to 1994-95)

Particular	Intercept	X _t	X _{t-1}	X _{t-2}	R ²
Wheat	3502.86** (263.15)	-0.08 ^{NS} (0.65)	0.03** (0.29)	0.17** (0.13)	0.60
Rice	4393.18** (511.73)	0.11** (0.24)	0.20* (0.72)	0.71* (0.35)	0.49
Maize	314.52** (156.87)	1.33** (2.34)	-0.79* (1.32)	-1.66* (.402)	0.72
Pulses	1015.66** (166.89)	-0.13 ^{NS} (0.07)	-0.05 ^{NS} (0.17)	0.02* (0.08)	0.56
Sugarcane	60605.12** (3578.50)	-0.48 ^{NS} (1.83)	-0.41 ^{NS} (7.92)	0.87* (3.97)	0.30
Oilseeds	3312.50** (185.06)	-0.35** (0.17)	0.52** (0.63)	0.01** (0.31)	0.66
Cotton	215.68** (194.05)	0.19* (0.07)	0.01* (0.19)	1.58* (0.09)	0.57
Cereals	5992.68** (1654.27)	0.11* (0.24)	0.14* (0.77)	0.41* (0.38)	0.48
Enterprises	934.47** (455.09)	2.86** (1.48)	2.80* (1.48)	3.42* (1.84)	0.83

Figure in parentheses are standard errors.

***and* Significance at 5 and 10 per cent respectively*

NS: Non-significant

The results depicted that value of R² in the case of maize was 0.72 and coefficient of research expenditure were statistically significant. In current year 't', productivity respond to research expenditure, thereafter, research expenditure on maize had no positive impact on productivity. Though, the research expenditure did not have positive impact on productivity but this expenditure was expanded to sustain the level of productivity and to develop cost effective technology. In the case of pulses and sugarcane it was observed that the values of coefficient of research expenditure were statistically significant in second year only, indicating that research expenditure had an impact on productivity with lag of two years and the R² came out to be 0.56 and 0.30 in the case of pulses and sugarcane, respectively. The research expenditure on cotton and cereals had positive impact on productivity and its impact was highest in the second year. The value of R² came out to be 0.57 and 0.48 for

oilseeds and cereals respectively. Same was true in the case of enterprises and the value of R^2 in the case of enterprises was 0.83. In the case of oilseeds, productivity responded to research expenditure with time lag and its response was highest in Period-I and value of R^2 was 0.66.

Research investment by the Punjab Agricultural University: 1995-96 to 2009-10

The result presented in the Table 5 indicates that research expenditure had a positive impact on wheat productivity in current year and was statistically significant. The value of R^2 came out to be 0.63. Further, it was observed that in the case of rice, productivity responds to research expenditure but with a time gap of two years and same trend was observed for sugarcane and enterprises.

Table 5: Regression analysis of research investment by Punjab Agricultural University in respect of crops and enterprises (1995-96 to 2009-10)

Particular	Intercept	X_t	X_{t-1}	X_{t-2}	R^2
Wheat	4150** (192.63)	0.15** (0.09)	-	-	0.63
Rice	3199.02** (286.63)	0.19 ^{NS} (0.16)	0.02 ^{NS} (0.73)	0.19** (0.38)	0.58
Sugarcane	62092.77** (1719.89)	-0.29 ^{NS} (0.86)	-0.1.23 ^{NS} (3.24)	0.38** (1.59)	0.30
Oilseeds	3312.50** (185.06)	-0.35** (0.17)	0.52** (0.63)	0.01** (0.31)	0.66
Cereals	8711.21** (574.99)	0.37** (0.16)	-	-	0.65
Enterprises	1840.84** (301.56)	-0.59 ^{NS} (1.06)	-0.37 ^{NS} (3.68)	1.32* (1.80)	0.65

*Figure within parentheses are standard errors
**and* Significance at 5 and 10 per cent respectively
NS: Non-significant*

The value of R^2 was 0.58, 0.30 and 0.65 in the case of rice, sugarcane and enterprises respectively. The value of R^2 for oilseeds was 0.66 and the coefficient of research expenditure was significant at five per cent level for all the year. The statistically significant negative coefficient of research expenditure during current year indicated that, level of productivity remained almost constant in year 't' without responding to research expenditure. The research expenditure impact on oilseeds was highest with lag of year one. The value of R^2 in the case of cereals came out to be 0.65 and the coefficient of research expenditure were significant at five per cent level

in current year, indicating that impact of research expenditure on productivity was realized in the year in which expenditure was incurred.

From the above discussion it was observed that public investment in agriculture research has positive but lagged impact on productivity of crops and enterprises. Further, the length of lag varies across the crops. The productivities of major crops (wheat, rice and sugarcane) in the state had already reached the plateau this was the main reason for the lag relationship between research investment and productivity.

Conclusions

Overview of growth analysis of research expenditure and productivity revealed in the case of crops like oilseeds, maize and pulses the research expenditure and productivity moves in almost opposite direction but in the case of other crops the research expenditure and productivity showed positive relationship. This calls for more investment to augment production for sustained development of farm sector. The impact of public sector investment on productivity of crops/enterprises was positive but with lapse of time. The study pointed out that there is a need of sustained public investment so as to raise the productivity of crops and allied enterprises such as mushroom farming, beekeeping, etc.

References

- Nath, V. 1998. Trend in public investment in agriculture. *Research paper*. Culled from www.vikasnath.org.
- Pal, S. 2008. Agricultural R&D policy and institutional reforms: Learning from the experience of India and China. *Economic and Political Weekly*. **43**:145-155.
- Singh, R. 1975. On optimum stratification for proportional allocation. *Sankhya*. **37**: 109-115.

Appendix

Productivities of different crops in Punjab

Year	Wheat	Rice	Maize	Sugarcane	Cotton	Oilseeds	Pulses
1985-86	3531	3200	1585	64744	426	1976	750
1986-87	2966	3331	2023	62990	507	1856	805
1987-88	3540	3164	1566	54906	510	1754	827
1988-89	3667	2769	1177	61856	475	2000	705
1989-90	3593	3510	1900	63107	570	3339	562
1990-91	3715	3229	1787	59406	463	3407	697
1991-92	3803	3257	1960	63486	607	3741	721
1992-93	3777	3392	2296	61416	570	3661	766
1993-94	4011	3508	1855	60779	446	3563	729
1994-95	4089	3384	1861	61875	499	4122	778
1995-96	3884	3128	1795	64800	447	3540	833
1996-97	4234	3397	2120	63815	441	3811	790
1997-98	3853	3465	2091	56746	220	3319	794
1998-99	4330	3153	2286	59515	180	3151	639
1999-00	4696	3347	2577	62685	340	3482	628
2000-01	4563	3506	2794	64215	430	3363	628
2001-02	4532	3545	2721	65141	370	3619	677
2002-03	4200	3510	2039	60325	410	3186	586
2003-04	4207	3694	2980	53821	556	3801	776
2004-05	4221	3943	2740	60116	697	3696	766
5002-06	4179	3858	2723	57857	731	3596	784
2006-07	4210	3868	3123	60808	750	3627	794
2007-08	4507	4019	3405	60818	663	3950	748
2008-09	4462	4022	3403	57660	737	3725*	775*

Source: CMIE

**Anticipated.*

RELATIONSHIP BETWEEN ASSET FORMATION AND INDEBTEDNESS AMONG PUNJAB FARMERS

Simpy*, V.K. Sharma*, Varinder Pal Singh** and H. S. Kingra*

Abstract

The study was conducted in Ludhiana district of Punjab state to examine the various aspects related with the asset formation and indebtedness and their relationship among the farmers. The results of the study brought out that the assets formation on the per hectare basis was to the tune of ₹ 110228 and it was the highest among the marginal farmers (₹ 145765) and lowest among the large farmers (₹ 102169). The income from crops was found to be higher among large farmers (67.02 per cent) and lowest on marginal farmers (27.24 per cent). Further, the share of dairy income was highest among marginal farmers with 70.07 per cent and lowest among the large farmers (31.28 per cent). On per hectare basis, the total requirement of funds for assets creation was higher among marginal farmers (₹ 145764) and the lowest among the large farmers (₹ 102169). The share of owned funds and repayment capacity was found to be the lowest among marginal farmers due to their small land holdings and hence lower farm income level. The proportion of borrowed funds and outstandings was the highest among marginal farmers and lowest among large farmers. The relation between long term credit and assets formation was found to have positive and significant. As the long term credit increased, assets formation also increased. The credit and assets formation found to be highly correlated among all the categories. The results revealed that institutional credit was highly correlated with the assets value. The share of non-institutional credit and farm size had an inverse relation.

Introduction

Agriculture sector plays an important role in the Indian economy. As agriculture contributes about 18 per cent in gross domestic product and about two third population of the country is engaged in this sector, thus, the economic development of the country depends upon the achievements of agricultural sector.

* Department of Economics and Sociology, Punjab Agricultural University, Ludhiana.

** College of Dairy Science and Technology, GADVASU, Ludhiana-141004

During the late sixties and early seventies the capital formation was very high which gave fillip to the economy of India through developing irrigation structure, farm machineries and equipments. But after 1980's the public investment on agriculture has been declining in the country. The public investment in 1980-81 was 38.7 per cent and in 2008-09 was 17.6 per cent. But at the same time the private investment was increased from 61.3 per cent in 1980-81 to 82.4 per cent in 2008-09 (Anonymous, 2010)

In the case of Punjab, the agriculture has been transformed from subsistence to self sufficiency and then to commercial agriculture. With the commercialization of farming the most important task faced, was to increase in production. Adoption of new technologies was the most important factor contributing to the increased productivity. At the same time Punjab was on the forefront in the adoption of new technologies, which resulted into increase use of capital intensive inputs. Thus, to finance a farm business, farmers needs capital and hence, the capital is the most vital input required for achieving the growth of agriculture. The investment in farms buildings, machineries and equipments, irrigation structures and milch animals constitutes the investment in fixed farm assets. Presently there are 4.25 lakhs tractors, 2.24 lakhs harrow, 1.4 lakhs combines and 8.22 lakhs thresher in the state, which have made the agricultural production process capital intensive (Anonymous, 2009).

It is, however, still being reported that the institutional lending is inadequate and cumbersome and the farmers have to resort to the private non-institutional sources of finance, which have their own ways of exploitation and squeezing the farmers' incomes. The non-institutional sources, mainly the commission agents have a strong ground in Punjab. The total debt taken by farmers from 20000 Arhtiyas was 800 crores in 2010. Besides the increase in farm credit on account of increase in cash costs and for capital investments, the stagnating growth in farm productivity, decreasing profitability and the increasing non-farm expenditure in rural areas for house construction, for improving and maintaining the living standards, for some social obligations being met beyond means, etc. were the main reasons for the increase in farmers' indebtedness in Punjab (Singh *et al.*, 2007). Despite the adoption of new agricultural technologies which has resulted in substantial improvement in agricultural output as well as improvement in distribution of credit through institutional sources, indebtedness among the farmers household was found to be widespread even today. About 89 percent of farm households in Punjab were indebted and more over all of the farm size categories were equally indebted in percentage terms (Singh *et al.*, 2008). In Punjab the total debt in 2010 was 35000 crore from which ` 21700 crore was from institutional and ` 13300 crores was from

non-institutional sources. Thus, the high indebtedness is a serious concern for future investments in agriculture. As majority of farmers are still continuing in agriculture in absence of any other economically viable alternative. The growing unrest requires adequate attention towards the farming community. The specific objectives of the study were:

- i. to study the asset formation among different categories of farmers,
- ii. to highlight the indebtedness among different categories of farmers and
- iii. to examine the relationship between asset formation and indebtedness among the different categories of farmers in Punjab.

Methodology

The study was conducted in the Ludhiana district of Punjab state. Three stage random sampling technique with blocks as first stage sampling unit, villages as second stage sampling unit and ultimate respondents as the third stage sampling unit was adopted. A list of all blocks falling in Ludhiana district was prepared, and two blocks were selected randomly. Further, a list of all the villages falling in two selected blocks was prepared and from this list, two villages from each selected block was chosen randomly. A cluster of three villages nearest to the each selected village were formed, in the case of non availability of respondents in any category. From each selected villages, 15 marginal (< 1 ha), 36 small (1-2 ha), 34 semi-medium (2-4 ha), 10 medium (4-6 ha) and 25 large (>6ha) farmers were selected by Probability Proportion to Size Method (PPS). Thus, in whole 120 farmers of different categories were selected. The information required from the farmers were collected for the agricultural year 2008-09 with the help of specially design and pre tested schedule through personal interview method.

Regression Analysis

Both liner and log liner from of regression were tried for the analysis of data. Finally linear form of equation was chosen for the study keeping in view:

- i. Higher value of R^2
- ii. Economic significance of regression coefficients and,
- iii. Logical significance of regression coefficients.

The algebraic form of linear regression is as under:

$$Y = a + b_1X_1 + \mu_1$$

Y = Assets formation (₹)

X = Credit (₹)

μ_1 = A random error terms

b_1 to b_n = Regression coefficients of independent variables

Correlation analysis

Correlation was also computed order to examine the relationship between assets formation and indebtedness.

Results and Discussion

Total value of different farm assets per farm

The results presented in Table 1 described the per farm assets formation on different farm size categories. In the overall analysis the total assets formation on per farm basis was ₹ 383272. The percentage of machinery was 47.60 followed by livestock (20.88 per cent), farm buildings (17.24 percent) and irrigation structure (14.28 percent).

Table 1: Total value of different farm assets

Farm Assets	₹ farm ⁻¹					
	Marginal	Small	Semi Medium	Medium	Large	Overall
Machinery	13836 (13.00)	47982 (24.90)	122278 (39.01)	295140 (53.02)	479756 (61.06)	182455 (47.60)
Irrigation Structure	19660 (18.48)	25349 (13.15)	49990 (15.95)	76848 (13.80)	104745 (13.33)	54716 (14.28)
Farm Buildings	30110 (28.30)	48326 (25.08)	72202 (23.03)	78001 (14.01)	98947 (12.59)	66075 (17.24)
Livestock	42801 (40.22)	71038 (36.87)	69008 (22.01)	106717 (19.17)	102231 (13.01)	80026 (20.88)
Total	106408	192695	313478	556705	785680	383272

Figures in the parentheses denote the percentages to the total.

In the category wise analysis the percent value of machinery was highest in large farmers (61.06) followed by medium farmers (53.02) and was lowest among marginal farmers (13.00). The reason behind the low percent value of machinery among the marginal farmers was that the marginal farmers have small land holdings and they prefer to hire the farm machinery for their farm operations. The percentage value of irrigation structure was highest among marginal farmers (18.48) followed by semi-medium (15.95), medium (13.80), large (13.33) and small farmers (13.15) respectively. There was an inverse relation between farm buildings and farm size. The percentage value of farm building was higher among marginal farm category (28.30 per cent) which was followed by small (25.08) and semi-medium (23.03). The perusal of Table 1 also revealed that the percent value of livestock was highest among the

marginal (40.22) and small farmers (36.87) and lowest among the medium (19.17) and large farmers (13.01). The obvious reason behind the higher percent value of livestock among small farms was that livestock was a major source of supplementing the income source of these farm categories.

Total value of different farm assets per hectare

The data given in Table 2 showed that total asset formation was ₹110228 on per hectare basis. In the overall analysis the expenditure on machinery was ₹ 52474 per hectare followed by livestock (₹ 23015) and farm buildings (₹ 19003), and irrigation structure (₹15736). In the category-wise analysis the proportion of expenditure on machinery found to have increased as the farm size increased. The value of machinery was highest in large farmers (₹62387) which followed by medium farmers (₹56867) and lowest in the case of marginal farmers (₹ 18954). The value of irrigation structure have an inverse relation with the farm size.

Table 2: Total value of different farm assets

Farm Assets	Marginal	Small	Semi Medium	Medium	Large	(₹ ha ⁻¹)
						Overall
Machinery	18954	32641	43985	56867	62387	52474
Irrigation Structure	26932	17244	17982	14807	13621	15736
Farm Buildings	41247	32875	25972	15029	12867	19003
Livestock	58632	48325	24823	20562	13294	23015
Total	145765	131085	112762	107265	102169	110228

Figures in the parentheses denote the percentages to the total.

The value of irrigation structure was highest among the marginal farmers (₹ 26932) followed by semi-medium (₹17982) and small farmers (₹17244) respectively and was lowest in the case of large farmers (₹13621). The value of farm buildings has also inverse relation with the farm size, as the farm size increased, the value of farm buildings decreased. The value of farm buildings was higher among the marginal and small categories with ₹41247 and ₹32875 respectively. The value of livestock was highest in the case of marginal (₹58632) which was followed by small farmers (₹ 48325) and found to be lowest among the large farmers (₹13294).

Farm family income from different sources

The data presented in Table 3 constitutes the contribution of different sources towards farm family income for different size categories of farms for the year 2008-

09. Here it is important to state that income from crop was included in farm income while income from dairy was included in non-farm income. In the overall analysis, the total income of the farmer was ₹ 357789. The income from the crops was above fifty percent (53.73 per cent) and the per cent age of total non-farm income was 46.27 per cent including income from dairy (44.33 per cent). The income from salary wages and pensions was 1.16 per cent while income from business was 0.50 per cent and the percentage of income from remittance from abroad was 0.20 per cent. In the category-wise analysis showed that the income from crop was increasing with the increase in the farm size as the economy of scale was prevailing on large farms.

Table 3: Farm family income from different sources

	(₹ farm ⁻¹)					
Sources of Income	Marginal	Small	Semi-Medium	Medium	Large	Overall
Crops	41867 (27.24)	83020 (38.37)	155155 (47.37)	286727 (59.73)	416306 (67.02)	192243 (53.73)
Dairy	107711 (70.07)	127922 (59.12)	166198 (50.74)	184615 (38.46)	194320 (31.28)	158590 (44.33)
Salaries, wages, pension	2349 (1.53)	3167 (1.46)	3662 (1.12)	5271 (1.10)	6324 (1.02)	4137 (1.16)
Business	1107 (0.72)	1477 (0.68)	1623 (0.50)	2134 (0.44)	2671 (0.43)	1785 (0.50)
Remittances	467 (0.30)	511 (0.24)	634 (0.19)	895 (0.19)	1109 (0.18)	715 (0.20)
Rent(Land/ House/Shop)	98 (0.06)	113 (0.05)	137 (0.04)	182 (0.04)	217 (0.03)	149 (0.04)
Miscellaneous	114 (0.07)	149 (0.07)	162 (0.05)	198 (0.04)	237 (0.04)	171 (0.05)
Total Non-Farm Income	111846 (72.76)	133339 (61.63)	172416 (52.63)	193295 (40.27)	204878 (32.98)	165546 (46.27)
Total	153713 (100.00)	216359 (100.00)	327571 (100.00)	480022 (100.00)	621184 (100.00)	357789 (100.00)

Figures in the parentheses denote the percentages to the total.

The income from crop was highest in the category of large farmers (67.02 percent) followed by medium (59.73 percent) and semi-medium farmers (47.37 percent) respectively. The percentage of income from crops was lowest among marginal farmers (13 percent), because of their small land holdings. On the other hand, the income from dairy has an inverse relation with the farm size. The income from dairy increased as the farm size decreased. The income from dairy was highest in the case of marginal farmers (70 percent) followed by small farmers (59.12

percent) and found to be lowest in the case of large farmers (31.28 per cent). The obvious reason behind the highest share of income from dairy was that due to small land holdings the dairy sector supplementing the income of small farms. The income from salaries, wages and pension was 1.53 per cent for marginal farmers, 1.46 per cent for small farmers, followed by semi-medium (1.12 percent), medium (1.10 percent) and the large farmers (1.02 percent). The share of total non-farm income was found to be higher among marginal farmers (72.76 percent), followed by small farmers (61.63 percent) and large farmers (32.98 percent), respectively.

Requirement of funds for the purchase of different assets

The various sources of funds used for assets formation by different categories are discussed in the Table 4. The results revealed that total requirement of funds for the assets formation among farmers was ₹ 383272. About 55.64 per cent of the total amount required was used from owned resources for asset formation while 40.97 per cent was used from borrowed funds.

Table 4: Requirement of funds for the purchase of different assets

	(₹ farm ⁻¹)					
Sources of Fund	Marginal	Small	Semi-Medium	Medium	Large	Overall
Total Requirement	106408	192695	313478	556705	785680	383272
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)
Owened Sources	31554	74243	151243	341478	501119	213250
	(29.65)	(38.53)	(48.25)	(61.34)	(63.78)	(55.64)
Borrowed	74854	118452	162235	215227	284561	157045
	(70.35)	(61.47)	(51.75)	(38.66)	(36.22)	(40.97)
Repaid	34887	70191	104577	146538	199795	110531
	(46.61)	(59.26)	(64.46)	(68.09)	(70.21)	(70.38)
Outstanding	39967	48261	57658	68689	84766	59491
	(53.39)	(40.74)	(35.54)	(31.91)	(29.79)	(37.88)

Figures in the parentheses denote the percentages to the total.

Out of these borrowed funds, the share of repayment was 70.38 per cent and the share of outstanding was 37.88 per cent during the study period. The category-wise analysis showed the percentage of owned sources was higher among large (63.78 percent) followed by medium farmers (61.34 percent) and it was quite lower among marginal (29.65 percent) and small farmers (38.53 percent), indicating that the percentage of own sources increased as the farm size increased. The study also brought out that 70.35 per cent funds were borrowed by marginal farmers and 61.47 per cent by small farmers, followed by medium farmers and large farmers with 38.66

per cent and 36.22 per cent respectively. The repayment capacity was found to have a direct relation with the farm size. The share of repayment was 46.61 and 59.26 percent in the case of marginal farmers and small farmers, respectively. On the other hand the share of repayment capacity was higher among marginal (68.09 percent) and small farmers (70 percent). The share of outstanding was highest among marginal farmers (53.39 per cent) and lowest among large farmers (30 percent) which may be due to small land holdings, less income and lack of employment opportunities among the small farms.

Sources of funds for capital assets formation on different farm size categories

The results presented Table 5 show that the sources of fund used for capital assets formation among the different farm categories on the per hectare basis. The overall analysis brought out that total requirement of funds per hectare for the asset formation was `110136. The share of owned sources was `61279 and the share of funds borrowed to create assets was `45128 out of which the share of funds repaid was `31762 and the amount of outstanding fund was `17095. The category wise analysis revealed that the total requirement for funds to the marginal farmers was `145764 to create the assets while for the large farmers the total requirement was to the tune of `102169. On the per hectare basis the total requirement for the assets creation was found to be the highest in marginal category while least among large farmers. The study brought out that the share on owned sources increased, as the farm size increased, as the share of owned funds was `43225 and `65165 in the case of marginal and large farmers respectively.

Table 5: Sources of funds for capital assets formation on different farm categories

Sources of Fund	Marginal	Small	Semi Medium	Medium	Large	Overall (` ha ⁻¹)
Total Requirement	145764	131085	112762	107265	102169	110136
Owned Sources	43225	50505	54404	65795	65165	61279
Borrowed	102540	80580	58358	41470	37004	45128
Repaid	47790	47749	37618	28235	25981	31762
Outstanding	54749	32831	20740	13235	11023	17095

Further, it was observed that the share of borrowed funds decreased, as the farm size increased. In the case of marginal farmers, the borrowed fund was higher (`102540) while for the large farmers it came out to be was `37004. The repayment capacity of the borrowed funds was estimated to be `47790 for marginal farmers and

₹25981 for the large farmers. The outstanding amount was higher in marginal farmers (₹ 54749) while it was lowest with the large farmers (₹ 11023) which might be due to low level of income and less opportunities for on farm employment in the case of marginal farmers.

Relationship between long term credit and assets formation

The perusal of Table 6 reveals the relationship between long term credit and assets formation on different farm size categories. The overall analysis showed the value of the R² was 0.47. The value of R² in the different farm size categories was 0.49, 0.52, 0.47, 0.56 and 0.50 for marginal, small, semi-medium, medium and large respectively. The coefficient of credit was positive and significant statistically in all the farm size categories. Thus, it could be concluded that due to increase in the long term credit, assets formation also increased. The correlation between long term credit and assets formation was found to be highly correlated.

Table 6: Relationship between long term credit and assets formation on different farm size categories (Liner regression analysis)

Farm category	Constant	Credit	R²
Marginal	0.98	1.27 ^{***} (2.77)	0.49
Small	0.54	1.54 ^{***} (2.37)	0.52
Semi-Medium	1.06	2.12 ^{***} (3.48)	0.47
Medium	1.23	2.43 ^{***} (3.21)	0.56
Large	0.87	3.87 ^{**} (2.52)	0.50
Overall	0.79	2.37 ^{***} (3.46)	0.47

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

Figures in parentheses are calculated t-values

Effect of institutional and non- institutional credit on assets formation

The relation between indebtedness and assets formation among the farmers of Ludhiana district is depicted in Table 7. The study brought out that on an average, the correlation coefficient between assets formation and institutional credit was 0.71 which is significant statistically. The correlation coefficient was 0.60 which was positively correlated with assets formation, indicating that as the non-institutional credit increases, assets formation also increases resulting in increase in indebtedness.

Table 7: Relationship between indebtedness and assets formation among the farmers

Farm Size Category	Assets Formation (Y)	Institutional Credit (X ₁)	rYX ₁	Non-Institutional Credit (X ₂)	rYX ₂	(₹ farm ⁻¹)	
						Total Credit (X)	rYX
Marginal	106408	51988	0.64 ^{***}	22866	0.16 ^{NS}	74854	0.70 ^{***}
Small	192695	73440	0.71 ^{***}	45012	0.26 ^{NS}	118452	0.72 ^{***}
Semi-Medium	313478	97341	0.69 ^{***}	64894	0.48 ^{**}	162235	0.69 ^{***}
Medium	556705	126984	0.71 ^{***}	88243	0.55 ^{***}	215227	0.75 ^{***}
Large	785680	156509	0.66 ^{***}	156509	0.82 ^{***}	284561	0.71 ^{***}
Overall	383272	10259	0.71 ^{***}	68763	0.60 ^{***}	170022	0.69 ^{***}

, ** and * significant at 10, 5 and 1 percent respectively.*

NS-Non-significant

Further, the category wise analysis revealed that in the case of marginal and small farmers, the correlation coefficient came out to be 0.16, 0.26 respectively which was non-significant statistically. This means the non-institutional credit for the marginal and small farmers did not play any effective role in the creation of assets. In the case of institutional credit, the correlation coefficient was 0.64, 0.71 for marginal and small farmers respectively, which was significant statistically, showing that the institutional sources played a major role in the creation of assets among marginal and small farmers. While in the other farm size categories, the institutional as well as non-institutional credit was positively correlated and found to be significant statistically. For the semi-medium farmers the correlation coefficient of institutional credit was found to be 0.69 which was significant statistically and the correlation coefficient of non-institutional credit came out to be 0.481 was significant statistically. This showed that as the institutional and non-institutional credit increased assets formation also increased for the above said category of the respondents. In the case of medium and large farmers the correlation coefficients for institutional credit were 0.71 and 0.66 respectively which was found to be significant statistically while in the case of non-institutional credit the value of correlation coefficient was 0.55 and 0.82 respectively which was found to be significant statistically.

Thus, from the above discussion it could be concluded that non-institutional sources have non-significant effect on assets formation in the case of marginal and

small farmers as the non-institutional sources provide less loans to these farmers because they did not have much land, and the repayment capacity of these farm size was also lower. Thereby, the non-institutional sources were reluctant to advance loan to these farm categories.

Institutional and non-institutional credit as proportion of assets formation

The institutional and non-institutional credit as proportion of assets formation is presented in Table 8. On an average, the percentage of assets generated with the help of institutional credit was 26.42 per cent while from non-institutional credits it was 17.94 per cent.

Table 8: Share of Institutional and non institutional credit as proportion of assets formation (₹ farm⁻¹)

Farm Size Category	Assets Formation	Institutional Credit	Percent of Assets	Non-Institutional Credit	Percent of Assets	Total Credit	Percent of Assets
Marginal	106408	51988	48.86	22866	21.49	74854	70.35
Small	192695	73440	38.11	45012	23.36	118452	61.47
Semi-Medium	313478	97341	31.05	64894	20.70	162235	51.75
Medium	556705	126984	22.81	88243	15.85	215227	38.66
Large	785680	156509	19.92	128052	16.30	284561	36.22
Overall	383272	101259	26.42	68763	17.94	170022	44.36

Further, the category-wise analysis brought out that 48.49 per cent of the marginal farmers took loan for asset formation from institutional sources, while 21.49 per cent of the asset was formed by taking loan from non-institutional sources. The share of institutional and non-institutional sources for assets creation was 38.11 and 23.36 per cent respectively in the case of small farmers. The semi-medium farmers took loan for asset creation to the tune of 31.05 and 20.70 per cent from institutional and non-institutional sources respectively. The medium and large farmers acquired loan from institutional sources to the tune of 22.81 and 19.92 per cent respectively. From non-institutional sources 15.85 and 16.30 per cent loan was taken by medium and large farmers respectively for assets creation. The main reason for the loan taken by the medium and large farmers from non-institutional and institutional sources was due to their comparatively higher income from crop farming and they spent a large share of their own money on assets formation.

Conclusions

From the foregoing discussion, it may be concluded that the assets formation on the per hectare basis was the highest among the marginal farmers and the lowest

among the large farmers. The percentage of the amount spent on machinery was the highest among large farmers while the marginal farmers having the small land holdings preferred to hire the farm machinery for their farm operations. The share of income from crops was found to be higher in large farmers and that from dairy sector was the highest among the small farmers because of their small land holdings, the dairy sector supplemented the income of small farmers. The share of owned funds to create farm assets was higher among large farmers while it was lowest among the marginal farmers. The loan repayment capacity was found to be higher among the large farmers and lowest among marginal farmers. The loan outstandings was higher among small farms while it was lowest among large farms. Due to lower income of the farmers, they took loan for assets creation. On the per hectare basis, the total requirement of funds for assets creation was higher among marginal farmers and lowest among the large farmers. The share of owned funds and repayment capacity was lowest in the case of marginal farmers, while it was the highest in the case of large farmers. The proportion of borrowed funds and their outstandings was the highest among marginal farmers and lowest among large farmers. The long term credit and assets formation were found to have a positive and significant co-relation. As the long term credit increased, assets formation also increased. The credit and assets formation was highly correlated among all the categories. It was found that institutional credit was highly correlated with the assets formation, thus, the institutional sources played a major role in the creation of assets among marginal and small farmers.

References

- Anonymous. 2009. *Statistical Abstract of Punjab*, Government of Punjab, Chandigarh.
- Anonymous. 2010. *Economic Survey of India*, Government of India, New Delhi.
- Singh, S., Kaur, M. and Kingra, H.S. 2007. *Flow of funds to farmers and indebtedness in Punjab. Research Report*. Department of Economics and Sociology, Punjab Agricultural University, Ludhiana
- Singh, S., Kaur, M. and Kingra, H.S. 2008. Indebtedness among farmers in Punjab. *Economic and Political Weekly*. **43**:130-136.

BEHAVIOUR AND MAGNITUDE OF CHANGING CLIMATE PATTERN IN CENTRAL PUNJAB: A CASE STUDY OF LUDHIANA DISTRICT

Deepak Upadhyia and D.K. Grover *

Abstract

The changing climate pattern in terms of maximum and minimum temperature, rainfall and relative humidity were analyzed based on relevant time series data/information for about four decades in Ludhiana district of Punjab using statistical tools such as coefficient of variation, graphical representation and samples mean (t-test) for periodical shifts. The study has brought out that during the last four decades, region experienced significant increase in average temperature (both maximum as well as minimum temperature) for the months of February, March, April, August and November. Similarly, months of May, October and December experienced significant increment of average minimum temperature. On the whole, consistent rise in average monthly temperature leading to enhanced level of warming has been observed. Significant changes in rainfall were observed in months of March, September, October, November and December. Among these, average rainfall in the months of March, November and December showed a significant decrease while September and October months showed a significant increase over the last about four decades. Monthly relative humidity increased in almost all months except April. In case such climate trend continues over the next few decades, may have detrimental effects on the agricultural output if suitable climate adaptive strategies are not put in place with top priorities in terms of suitable research and development.

Introduction

The climate change is not a new or an emerging issue, but, considered as a major issue of 21st century. The latest scientific studies reveal that a rise in global mean temperature and its adverse effects are appreciable and mounting. Because of which there is an increase in global concern and awareness in climatic matters among

* M.Sc. Scholar, and Director, Agro-Economic Research Center, Department of Economics and Sociology, Punjab Agriculture University, Ludhiana-141004

the policy makers and researchers in recent times. The other probable reasons behind these may be increasing anthropogenic influence on environment (also to climate). About the human influence on climate is cleared by the definition given by United Nations Framework Convention on Climate Change. The climate change is a change greater than natural climate variability observed over a comparable period of time in climate status; this variation being attributable to an alternation in the composition of the global atmosphere, directly or indirectly caused by human activity (Anonymous, 1992). Similarly, the effort of Rio de Janero, 1992 Earth Summit to put environment on the top of political agenda shows the rising world concern on climate change.

The Intergovernmental Panel for Climate Change (IPCC, 2007) reported that eleven of the last thirteen years (1995-2007) rank among the twelve warmest years in the instrumental record of global surface temperature. The change is not only observed in temperature but also in other climatic factors like downward trend in relative humidity, annual rainfall and number of wet days in a year. A case of neighboring country Nepal showed that there traditional rainfall was occurred in the mid of July in past years which have been shifted to mid August in recent years. This has affected rice production adversely (Malla, 2008). Coming to India, it is reported based on time series data that the surface air temperature increased by 0.6⁰C over the past 100 years (Rupa *et al.*, 2006). There is marked changes in rainfall pattern during recent periods. The year 2002 was a typical example of this changing scenario. In this year there was 19 percent deficit in rainfall. Similarly, the years 1972, 1979, 1987, 2002 and 2009 were recognized as the severe drought years (Rao, 2010). Along with these, the frequency of hot days and multiple day heat waves have increased in past century in India (Lal, 2003).

Owing to the advent of *Green Revolution* technology and enhanced level of chemical fertilizers there has been spurt hike in the agricultural productivities along with huge emission of carbon dioxide and other green house gases in the state of Punjab too (Dubey, 2008). A study carried out by PAU reported that the minimum night temperature in Punjab has increased by 1⁰C over the period of 40 years (Anonymous, 2012). Though, the issue of climate change in terms of average minimum temperature, maximum temperature, rainfall as well as humidity, etc. has been a matter of concern to agricultural experts, yet there has been no systematic study conducted on the issue especially in an agriculturally advanced state of Punjab. The present study is an attempt in this direction. The specific objectives of the study were:

- i. to study the temporal movements in monthly average temperature (minimum and maximum) in Central Punjab,
- ii. to examine the changing rainfall pattern over time in Central Punjab and
- iii. to study the changing behavior of relative humidity in Central Punjab.

Methodology

The study was conducted in Ludhiana district of Punjab which is at 30°55' N latitude and 75°51' E longitude. To accomplish the objectives of the study, surface air temperature (Mean Maximum and Mean Minimum), rainfall and relative humidity data have been collected and analyzed for the period 1972-2010. The daily data on these climate parameters for 39 years were collected from the Department of Agro-Meteorology, Punjab Agricultural University, Ludhiana. The data were averaged out on monthly basis. The data so collected were divided into three periods consisting of thirteen years each to evaluate the movements over the periods. The periods have been distinguished as Period-I (1972-84), Period-II (1985-97) and Period-III (1998-2010) and overall Period-IV (1972-2010). The graphical and simple statistical tools such as mean, simple deviation/standard deviation, coefficient of variation (CV), etc., were used to analyse the data. Further, t-test was employed to study the significance between the sample means.

Results and Discussion

The results have been discussed under the various sub-heads as under:

Temperature

Minimum temperature: Shift in minimum temperature in Ludhiana district of Punjab has been studied for the period 1972-10 and the same has been presented in Table 1. The minimum average temperature across the months was found to be the lowest during January, February and December (5.2 to 6.5⁰C) while highest during June, July and August (24.8 to 25.3⁰C) in Period-I (1972-84). Both lowest as well as highest temperature has been noticed increasing over the periods from 5.8 to 8.0⁰C, 25.9 to 26.4⁰C and 6.1 to 8.6⁰C & 26.2 to 26.9⁰C during Period-II (1985-97) and Period-III (1998-10) respectively. The data brings out that there has been consistent increase in the minimum average temperature all through 12 months during Period-III over Period-I indicating consistent rise in minimum average temperature. The statement is further supported by Figure 1, which shows the sketch of Period-III

remained over and above the sketches of Period-II as well as Period-I during all twelve months.

Table 1: Shifts and variation in monthly minimum average temperature in Ludhiana district of Punjab, 1972-2010

Month	Minimum average temperature ($^{\circ}\text{C}$)				Variation in minimum average temperature (Coefficient of Variation %)			
	Period-I	Period-II	Period-III	Period-IV	Period-I	Period-II	Period-III	Period-IV
January	5.2	5.8	6.1	5.7	28.43	19.21	21.16	23.1
February	6.5	8.0	8.6	7.7	18.39	13.41	14.55	18.8
March	10.7	11.7	12.9	11.8	9.27	8.20	8.83	11.4
April	16.5	16.6	18.4	17.2	6.79	5.70	5.88	7.9
May	21.6	22.3	23.9	22.6	5.23	6.42	5.46	7.1
June	24.9	25.9	26.2	25.7	5.02	2.84	3.04	4.3
July	25.3	26.4	26.9	26.2	2.74	2.16	1.98	3.4
August	24.8	26.3	26.4	25.8	3.16	8.48	1.82	6.0
September	21.6	23.3	23.5	22.8	5.87	3.40	3.38	5.6
October	15.5	16.5	17.6	16.5	8.97	5.90	6.89	8.9
November	9.7	11.1	11.4	10.7	17.30	6.13	6.34	12.4
December	5.6	7.2	6.8	6.6	20.54	10.39	19.61	19.5

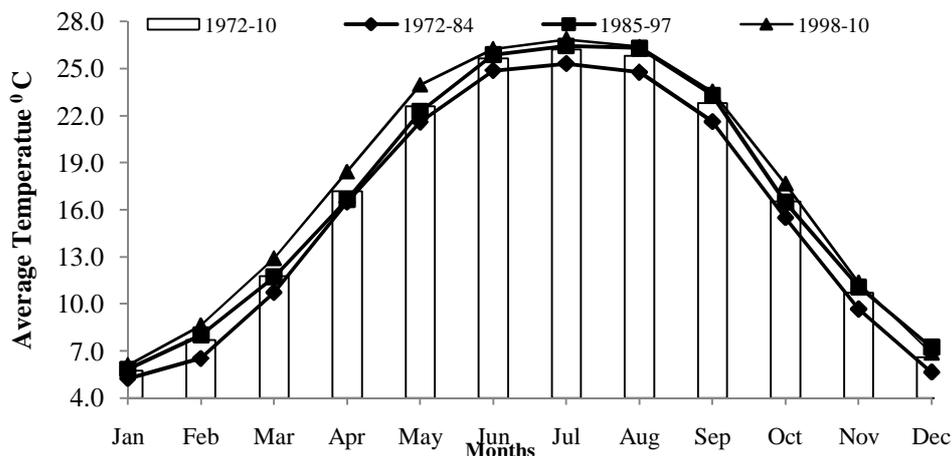


Figure 1: Shifts and variation in monthly minimum average temperature in Ludhiana district of Punjab, 1972-2010

The deviation in mean minimum temperature and its significance has been examined for individual months. The data depicted in Table 2 shows that most of the months witnessed abrupt rise in mean minimum temperature in Period-II over Period-I. Months with deviation $\geq 1^{\circ}\text{C}$ were February (1.5°C), March (1°C), June (1°C), July (1.1°C), August (1.6°C), September (1.7°C), October (1°C), November (1.4°C) and December (1.6°C), while, the months with increment $< 1.0^{\circ}\text{C}$ were January (0.6°C), April (0.2°C) and May (0.7°C). Except for January and April, other months showed

significant increment in minimum average temperature at different level of significance (Table 2). Almost similar picture of such deviations emerged in Period-III over Period-II, depicting an increment in mean minimum temperature for all the months except December. The deviations during Period-III over Period-II were relatively more prominent for the months of March (1.2⁰C), April (1.8⁰C), May (1.7⁰C), July (0.4⁰C) and October (1.1). An upward movement in average minimum temperature for January, February, June, August, September and November was observed though the deviations were marginal and non-significant.

The deviations in minimum average temperature during Period-III over base Period-I visibly depict increment in all the twelve months. The magnitude of increment deviations has been categorized as $\geq 2.0^{\circ}\text{C}$ and $< 2.0^{\circ}\text{C}$. The high deviation months were February (2.1⁰C), March (2.2⁰C), May (2.4⁰C) and October (2.1⁰C) and incremental increase was statistically significant. The low deviation months were January (0.8⁰C), April (1.9⁰C), June (1.4⁰C), July (1.5⁰C), August (1.6⁰C), September (1.9⁰C), November (1.7⁰C) and December (1.2⁰C). Except for the months of January and December, the increment in average monthly maximum temperature in this category was also found to be statistically significant.

Table 2: Periodical deviation in average monthly temperature in Ludhiana district of Punjab

Months	1985-97 over 1972-84		1998-10 over 1985-97		1998-10 over 1972-84	
	Mean difference	t ₁	Mean difference	t ₂	Mean difference	t ₃
January	0.6	1.1514 ^{NS}	0.2	0.5073 ^{NS}	0.8	1.5306 [*]
February	1.5	3.3378 ^{***}	0.6	1.2919 ^{NS}	2.1	4.3295 ^{***}
March	1	2.5715 ^{***}	1.2	2.8561 ^{***}	2.2	5.1665 ^{***}
April	0.2	0.4017 ^{NS}	1.8	4.4278 ^{***}	1.9	4.4728 ^{***}
May	0.7	1.3416 [*]	1.7	3.1238 ^{***}	2.4	4.9208 ^{***}
June	1	2.5302 ^{***}	0.3	1.1311 ^{NS}	1.4	3.3015 ^{***}
July	1.1	4.5065 ^{***}	0.4	1.9396 ^{**}	1.5	6.3614 ^{***}
August	1.6	2.3694 ^{**}	0.1	0.1069 ^{NS}	1.6	6.3703 ^{***}
September	1.7	4.0702 ^{***}	0.2	0.7221 ^{NS}	1.9	4.6069 ^{***}
October	1	2.1304 ^{**}	1.1	2.6525 ^{***}	2.1	4.1957 ^{***}
November	1.4	2.8380 ^{***}	0.3	0.9827 ^{NS}	1.7	3.3480 ^{***}
December	1.6	4.1432 ^{***}	-0.4	-0.9078 ^{NS}	1.2	2.4396 ^{**}

***, ** and * indicates 1, 5 and 10 percent level of significance respectively

NS: Non-significant.

The coefficient of variation (CV) showed that during January, February, November and December in Period-I, January, February and December during periods II and III, variation in minimum average temperature was found to be double-digital indicating higher variation (Table 1). The results show decrease in the number of months with higher variation over the time period. On the other hand, during

Period-I, the lowest variation were recorded in the month of July (2.74 %) followed by August (3.16 %). Similarly, the lowest variation in Period-II were observed in July (2.16 %) followed by June (2.84 %). These variations were found to increase in August during Period-II. During Period-III, the month of August recorded the lowest minimum temperature variation among twelve months in its own entire period.

Hence, positive change in periodical monthly average minimum temperature clearly brings out that there has been steady and significant increase in minimum average temperature all across the 12 months in Ludhiana district of Punjab depicting emerging threats of climate change in the region.

Maximum temperature: The monthly average maximum temperature data for 39 years (1972-2010) were analyzed and the same has been set out in Table 3. The months with lowest average maximum temperature were January (18.5⁰C), February (20.4⁰C) and December (20.5⁰C) during Period-I, while April (34.1⁰C), May (38.8⁰), June (38.8⁰C) and July (34.4⁰C) experienced the highest average maximum temperature.

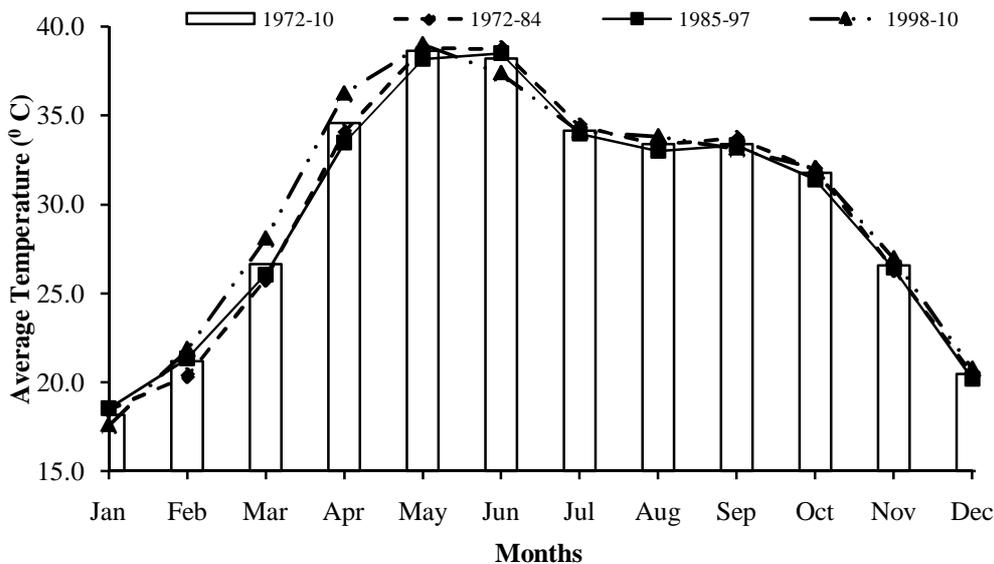


Figure 2: Shifts and variation in monthly maximum average temperature in Ludhiana district of Punjab, 1972-2010

The other months namely March, August, September, October and November recorded 25.8, 33.4, 33.7, 32 and 26.3 ⁰C respectively. The lowest average maximum temperature during Period-II over Period-I showed all the three possibilities as it remained the same in January (18.5⁰C), increased in February and

decreased in December (from 20.5 to 20.2⁰C). The increase was found to be statistically significant in the month of February.

The average maximum temperature of January during Period-III decreased significantly by 1⁰C over base Period-II. The highest average maximum temperature experienced increment, though non-significant, for all the months during Period-II over base Period-I. During 1998-2010, April was observed with significant increase of 2.7⁰C, while June experienced significant decrease of 1.2⁰C, compared to that of 1985-97. Similarly, during 1998-2010 April was observed with significant increase of 2.2⁰C, while June experienced significant decrease of 1.4⁰C compared to that of 1972-1984 (Table 4).

Among remnant months, March and November showed a regular increase from Period-I to Period-III, while September revealed the consistent decrease in average maximum temperature. Both August and October did not show a consistent pattern rather it shows irregular pattern as decrease in Period-II followed by increase in Period-III. The rate of increase in average maximum temperature during March in comparison of Period-II over base I, III over base II and III over base I was 0.3⁰C, 2.7⁰C and 2.2⁰C respectively. Increase during later two periods (2.7⁰C and 2.2⁰C) came out to be significant statistically. The positive incremental deviations (0.1, 0.5 and 0.6⁰C) November, 0.5⁰C (Period-III over Period-II) and 0.6⁰C (Period-III over Period-I) were found significant statistically. The negative deviations of 0.6⁰C in Period-III over I was found to be significant statistically in the month of September. The average maximum temperature during August, as a whole showed an increment because only positive incremental deviations were significant.

These observations were more explicitly explained with the help of graph (Figure 2) which shows the changing levels of average maximum temperature over the study periods. Outline of February, March, April, August and November during Period-III remained at distinct upper level over base Period-I, indicating significant increment in the average maximum temperature. On contrary, the sketch of January, June and September during Period-III distinctly remained at lower levels over base Period-I, depicting significant decrement. For the remaining months, the levels were not uniquely distinguished indicating only marginal change in the average maximum temperature in the region.

The coefficient of variation for monthly average maximum temperature, as demonstrated in Table 3 depicts that CV extended from 1.4 percent in October to 8.2 percent in March during Period-I, 2.8 percent in September to 8.2 percent in December during Period-II and 1.7 percent in August to 8.8 percent in January. Comparison of CV in Period-III over base Period-II shows increase in January,

February and March months while decrease for remaining months. Further, change in CV in Period-III over base Period-I shows increase for January, February, June and October while decrease for rest of the months.

Table 3: Shifts and variation in monthly maximum average temperature in Ludhiana, 1972-2010

Months	Maximum average temperature (⁰ C)				Variation in maximum average temperature (Coefficient of Variation %)			
	Period-I	Period-II	Period-III	Period-IV	Period-I	Period-II	Period-III	Period-IV
January	18.5	18.5	17.6	18.2	4.4	4.3	8.8	6.4
February	20.4	21.3	21.8	21.2	6.7	6.3	8.4	7.6
March	25.8	26.1	28.1	26.6	8.2	5.5	6.7	7.7
April	34.1	33.5	36.2	34.6	5.7	4.2	4.3	5.8
May	38.8	38.2	39	38.7	6.1	5.4	2.7	4.9
June	38.8	38.5	37.4	38.2	2.8	3.2	4.5	3.8
July	34.4	34	34.1	34.2	3.3	4.3	3.3	3.6
August	33.4	33	33.8	33.4	2.7	3.8	1.7	3.0
September	33.7	33.3	33.1	33.4	3.4	2.8	2.8	3.0
October	32	31.4	32	31.8	1.4	4.3	3.2	3.2
November	26.3	26.4	27	26.6	3.1	3.7	3.0	3.4
December	20.5	20.2	20.7	20.5	7.7	8.2	4.1	6.8

Table 4: Periodical deviation in average monthly maximum temperature in Ludhiana, Punjab

Months	1985-97 over 1972-84		1998-10 over 1985-97		1998-10 over 1972-84	
	Mean difference	t ₁	Mean difference	t ₂	Mean difference	t ₃
January	0.1	0.2318 ^{NS}	-1	-2.0006 ^{**}	-0.9	-1.8416 ^{**}
February	1	1.8219 ^{**}	0.5	0.804 ^{NS}	1.5	2.3257 ^{**}
March	0.3	0.358 ^{NS}	2	3.0725 ^{***}	2.3	2.8844 ^{***}
April	-0.6	-0.8611 ^{NS}	2.7	4.7086 ^{***}	2.2	3.1362 ^{***}
May	-0.6	-0.7249 ^{NS}	0.8	1.2732 ^{NS}	0.2	0.26 ^{NS}
June	-0.3	-0.5554 ^{NS}	-1.2	-1.9885 ^{**}	-1.4	-2.531 ^{***}
July	-0.4	-0.8319 ^{NS}	0.1	0.1589 ^{NS}	-0.3	-0.7832 ^{NS}
August	-0.3	-0.8002 ^{NS}	0.8	2.0724 ^{**}	0.5	1.5095 [*]
September	-0.4	-0.8944 ^{NS}	-0.2	-0.5936 ^{NS}	-0.6	-1.4191 [*]
October	-0.5	-1.3739 [*]	0.6	1.2947 ^{NS}	0.1	0.2151 ^{NS}
November	0.1	0.26944 ^{NS}	0.5	1.4602 [*]	0.6	1.9204 ^{**}
December	-0.3	-0.4062 ^{NS}	0.5	1.0379 ^{NS}	0.3	0.56001 ^{NS}

***, ** and * indicates 1, 5 and 10% level of significance respectively

NS: Non-significant

Hence, there has been significant increase in mean maximum temperature for most of the months (February, March, April, August and November). Increment has also been observed during May, October and December, though non-significant. During the last 39 years, Ludhiana district observed a significant increase in average temperature (both maximum as well as minimum temperature) for the months of February, March, April, August and November. Similarly, months of May, October and December experienced significant increment of average minimum temperature.

On the whole, study brought out that there was a consistent rise in average monthly temperature and leading to increased level of warming in the study region.

Rainfall

The average monthly rainfall over the periods has been presented in Table 5. Based on the rainfall intensity, months have been categorized as *major rainfall season (June-September)*, *intermediate rainfall season (January-May)* and *minor rainfall season (October-December)*. During *major rainfall season*, the average rainfall lessened during the first two months (June and July) while increased during August and September in Period-II over the base Period-I. The shift in rainfall trend turned around in Period-III over the base Period-II, revealing increased level of rainfall in June and July and decreased level of rainfall in August and September.

Table 5: Shifts and variation in average monthly rainfall in Ludhiana district of Punjab, 1972-2010

Months	Average rainfall (mm)				Variation in average rainfall (CV %)			
	Period-I	Period-II	Period-III	Period-IV	Period-I	Period-II	Period-III	Period-IV
January	31.5	24.5	26.2	27.4	91.0	103.4	81.7	90.6
February	31.7	28	35.9	31.9	81.2	67.6	113.6	92.0
March	28	22	15.5	21.9	86.7	94.0	99.4	94.2
April	25	45.5	16.4	29	143.6	247.6	122.7	236.6
May	20.9	23.2	24.5	22.9	121.0	137.4	95.0	115.4
June	63	59	88.9	70.3	68.5	67.4	86.2	79.5
July	243.1	200.3	245	229.5	50.5	77.9	60.8	61.5
August	188	214.6	160.3	187.6	49.2	75.4	64.1	64.8
September	50.4	167.1	97.1	104.9	84.6	131.3	63.2	132.5
October	3.5	9.2	18.7	10.5	204.7	166.6	189.3	219.2
November	11.2	7.1	2.1	6.8	205.6	132.7	194.1	216.0
December	17.8	26.2	7.1	17	137.4	121.2	102.1	142.3

Almost, a similar rainfall trend has been noticed in Period-III over the base Period-I except for the month of September. There was an increase in average rainfall received to the tune of 25.9, 1.9 and 46.7 mm during June, July and September respectively, while the rainfall has decreased by 27.7 mm in August (Table 6). An increased rainfall level in September during major rainfall season has been found as significant statistically. In *minor rainfall season*, October and November showed a regular pattern of change while December has witnessed the irregular pattern over the periods. The recorded average October rainfall in Period-I, II and III was 3.5, 9.2 and 18.7 mm respectively indicating regular increments over the time periods (Period-II over base Period-I, Period-III over base Period-II and Period-III over base Period-I). The rainfall increment in October during Period-III over base Period-I turned out to be significant statistically. Contrary to it, November rainfall decreased consistently during Period-I through Period-III (-4.1 mm in Period-II over base Period-I, -5.1 mm

in Period-III over base Period-II and -9.2 mm in Period-III over base Period-I) and was significant statistically.

During the *intermediate rainfall season* in Period-III over base Period-II, the rainfall increased during January and decreased during February, though statistically non significant. The rainfall decrement in the month of March is found significant statistically in Period-III over Period-I.

Table 6: Periodical deviation in average monthly rainfall in Ludhiana district of Punjab

Months	1985-97 over 1972-84		1998-10 over 1985-97		1998-10 over 1972-84	
	Mean difference	t ₁	Mean difference	t ₂	Mean difference	t ₃
January	-7	-0.661 ^{NS}	1.7	0.1824 ^{NS}	-5.3	-0.5379 ^{NS}
February	-3.8	-0.4271 ^{NS}	8	0.639 ^{NS}	4.2	0.3127 ^{NS}
March	-6	-0.6774 ^{NS}	-6.6	-0.918 ^{NS}	-12.6	-1.5753*
April	20.5	0.6242 ^{NS}	-29.1	-0.9177 ^{NS}	-8.7	-0.7581 ^{NS}
May	2.4	0.2084 ^{NS}	1.2	0.1123 ^{NS}	3.6	0.3763 ^{NS}
June	-4	-0.2482 ^{NS}	29.9	1.2508 ^{NS}	25.9	1.0621 ^{NS}
July	-42.8	-0.7767 ^{NS}	44.7	0.7467 ^{NS}	1.9	0.0356 ^{NS}
August	26.5	0.5139 ^{NS}	-54.3	-1.0217 ^{NS}	-27.7	-0.7233 ^{NS}
September	116.6	1.8823**	-70	-1.1078 ^{NS}	46.7	2.2527**
October	5.7	1.216 ^{NS}	9.5	0.8871 ^{NS}	15.2	1.5173*
November	-4.1	-0.5912 ^{NS}	-5.1	-1.7818**	-9.2	-1.4112*
December	8.4	0.7578 ^{NS}	-19.1	-2.117**	-10.7	-1.5153*

***, ** and * indicates 1, 5 and 10 percent level of significance respectively;
NS: Non-significant

The coefficient of variation of monthly average rainfall data for the Period-I, Period-II and III as well as over Period-IV has been analyzed and presented in Table 5. This clearly brings out that CV varied from 49.2 percent in August to as high as 205.6 percent in November during Period-I, from 67.4 percent in June to as high as 247.6 percent in April during Period-II, from 60.8 percent in July to 194.1 percent in November during Period-III and from 61.5 percent in July to 236.6 percent in April during the overall Period-IV. The rainfall during May, September, October, November and December remained highly unstable for Period-I, Period-II, Period-III as well as the overall Period-IV, being higher value of CV than the threshold level of 100 percent except in the month of May during Period-III and September during Period-I and III.

It was noticed that various months displayed a significant changes in rainfall in the months of March, September, October, November and December. Among these, average rainfall in the months of March, November and December showed a

significant decrease while September and October months show a significant increase over the period as also highlighted in Figure 3.

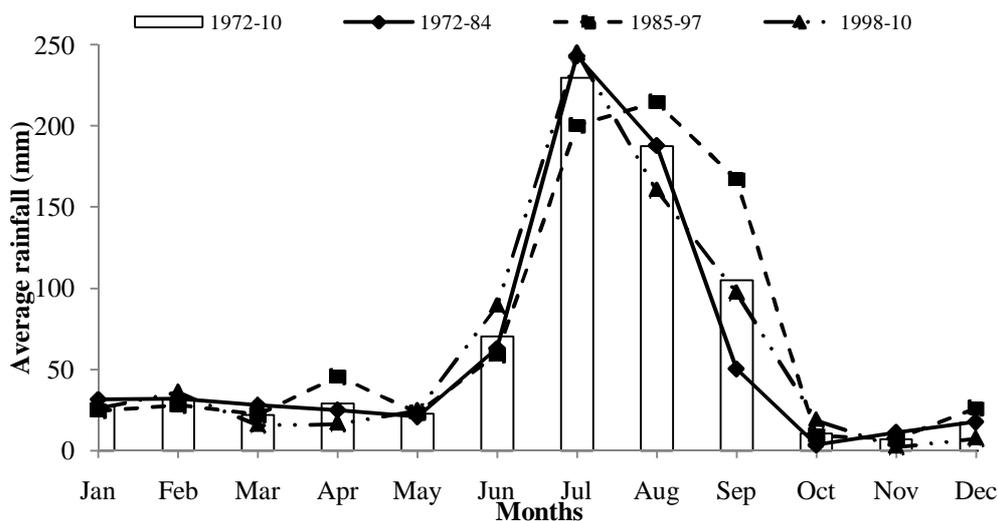


Figure 3: Shifts and variation in monthly average rainfall in Ludhiana district of Punjab, 1972-2010

Relative humidity

The monthly average relative humidity for Period-I, II, III and IV clearly depicts the cyclic nature (Figure 4) that is *fall (January-May)*, *rise (June-August)*, *fall (September-October)* and *rise (November-December)*. It can clearly be seen in Tables 7 and 8 that during *fall (January-May)*, January, mean differences of Period-II over base Period-I was 3.3 percent (significant at 5% level), Period-III over base Period-II was 4.5 percent (significant at 5% level) and Period-III over base Period-I was 7.8 percent (significant at 1% level). Assessment portrays positive mean difference of 2.4 percent (Period-III over base Period-II) and 4.1 percent (Period-III over base Period-I) in the month of February. Similarly, mean difference of 5.2 percent in Period-II over base Period-I and 5.4 percent in Period-III over base Period-I in the month of May has been found to be significant statistically. The humidity decrement in the month of April was found significant in Period-III over Period-I (mean difference of -4.3) and Period-III over Period-I (mean difference of -4.2) both were significant statistically (Table 8).

During *rise (June-August)*, the steady increase in average relative humidity over the periods have been noticed and found significant except August. Within June, average relative humidity during Period-I, II and III was 47.6, 51.6 and 57.5 percent

respectively showing the mean differences of 4 in Period-II over base Period-I, 6 in Period-III over base Period-II and 10 in Period-III over base Period-I and were found to be significant statistically. In July, positive change in Period-III over Period-II (mean difference of 4.4) and Period-III over Period-I (mean difference of 6) turned out to be statistically significant. During *fall (September-October)*, consistent increase in average relative humidity from Period-I to Period-III has been observed.

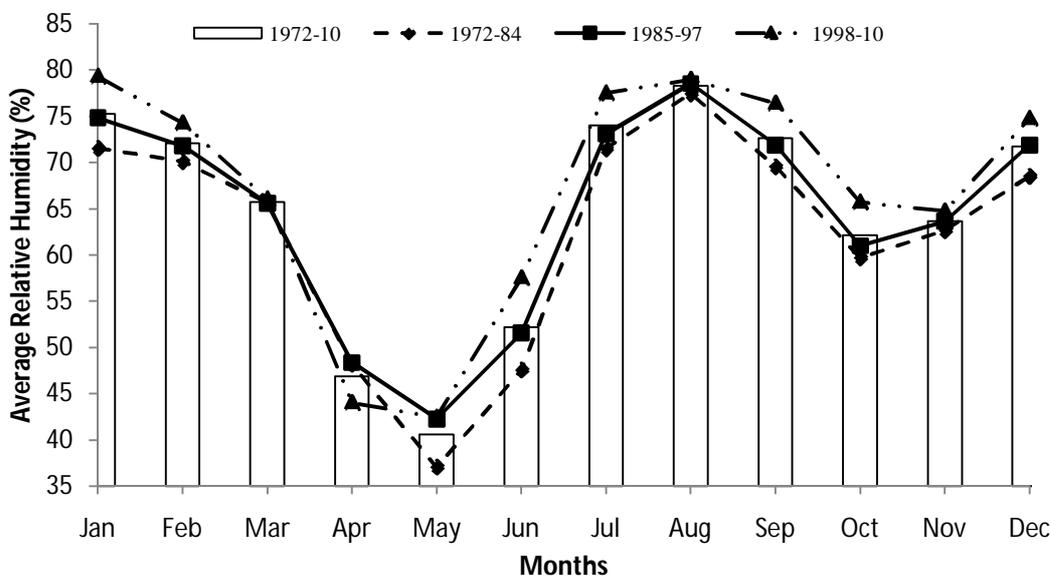


Fig 4: Shifts and variation in monthly average relative humidity in Ludhiana district of Punjab, 1972-2010

Table 7: Shifts and variation in monthly average relative humidity in Ludhiana district of Punjab, 1972-2010

Months	Average relative humidity (%)				Variation in Average relative humidity (Coefficient of variation %)			
	Period-I	Period-II	Period-III	Period-IV	Period-I	Period-II	Period-III	Period-IV
January	71.5	74.8	79.3	75.2	5.0	2.8	7.9	7.0
February	70.1	71.8	74.2	72	7.5	5.2	4.8	6.2
March	65.6	65.6	66	65.7	8.6	5.1	4.8	6.2
April	48.2	48.4	44	46.9	14.8	11.0	10.6	12.8
May	37.1	42.3	42.4	40.6	22.2	19.4	9.5	18.1
June	47.6	51.6	57.5	52.2	11.3	9.3	13.8	14.0
July	71.5	73.1	77.5	74	7.4	9.1	6.1	8.2
August	77.4	78.5	79	78.3	5.6	7.1	2.8	5.4
September	69.6	71.9	76.4	72.6	7.8	6.6	4.8	7.4
October	59.7	61	65.7	62.1	5.2	7.9	6.1	7.6
November	62.7	63.7	64.7	63.7	7.0	6.0	3.8	5.7
December	68.5	71.9	74.8	71.7	9.3	8.2	5.3	8.3

The positive mean difference of 4.5 and 6.8 during September and October in Period-III over base Period-I was significant statistically. During *rise (November-December)*, month of December experienced an average relative humidity increment from 68.5 percent in Period-I, 71.9 percent in Period-II and 74.8 percent in Period-III, showing significant increase in the humidity level over the periods and was significant statistically.

Table 8: Periodical deviation in average relative humidity in Ludhiana district of Punjab

Months	1985-97 over 1972-84		1998-10 over 1985-97		1998-10 over 1972-84	
	Mean difference	t ₁	Mean difference	t ₂	Mean difference	t ₃
January	3.3	2.8448 ^{***}	4.5	2.4615 ^{**}	7.8	3.9013 ^{***}
February	1.7	0.9421 ^{NS}	2.4	1.7023 [*]	4.1	2.3510 ^{**}
March	0	-0.0121 ^{NS}	0.5	0.3569 ^{NS}	0.4	0.2444 ^{NS}
April	0.2	0.0763 ^{NS}	-4.3	-2.2158 ^{**}	-4.2	-1.7609 ^{**}
May	5.2	1.6202 [*]	0.2	0.0653 ^{NS}	5.4	2.1184 ^{**}
June	4	2.0158 ^{**}	6	2.3169 ^{**}	10	3.7534 ^{***}
July	1.6	0.6607 ^{NS}	4.4	1.9495 ^{**}	6	3.0254 ^{***}
August	1.1	0.5591 ^{NS}	0.4	0.2669 ^{NS}	1.5	1.1497 ^{NS}
September	2.3	1.1675 ^{NS}	4.5	2.6944 ^{***}	6.8	3.7494 ^{***}
October	1.3	0.8147 ^{NS}	4.7	2.6999 ^{***}	6	4.2880 ^{***}
November	1	0.6154 ^{NS}	1.1	0.8491 ^{NS}	2.1	1.4832 [*]
December	3.3	1.3928 [*]	2.9	1.4672 [*]	6.2	2.9906 ^{**}

*****, ** and * indicates 1, 5 and 10 percent level of significance respectively
NS: Non-significant**

The analysis of coefficient of variation during Period-I, II, III as well as the overall Period-IV, presented in the Table 7 clearly indicates these variations stretched from 5 percent in January to 22.2 in May during Period-I, from 2.8 percent in January to 19.4 percent in May during Period-II, from 2.8 percent in August to 13.8 percent in June during Period-III and from 5.4 percent in August to 18.1 percent in May during the entire Period-IV. It means the lowermost and uppermost value of variation decreased in Period-III in comparison to remnant periods.

Conclusions

It can be inferred from the above analysis-based discussion that positive change in periodical monthly average minimum temperature has been steady and significant all across the twelve months in the study area, depicting emerging threats of climate change in the region. There has been significant increase in mean maximum temperature for most of the months (February, March, April, August and November). Increment has also been observed during May, October and December, though non-significant. During the last 39 years, Ludhiana district observed a significant

increase in average temperature (both maximum as well as minimum temperature) for the months of February, March, April, August and November. Similarly, months of May, October and December experienced significant increment of average minimum temperature. On the whole, study brought out the consistent rise in average monthly temperature and hence increased level of warming in the study region. The significant changes observed in rainfall were March, September, October, November and December. Among these, average rainfall in the months of March, November and December showed a significant decrease while September and October months showed a significant increase over the last about four decades. The monthly relative humidity increased in almost all months except April. Hence, enhanced level of temperature, increase in post-monsoon rainfall and decrease in winter rainfall along with explicit increase in relative humidity is a clear indication of growing threat of climate change for the agricultural sector. Thus, estimation of changing climate parameters over the last four decades in the region clearly pointing out the likely adverse effect on the crop productivities both in *Rabi* as well as *Kharif* season. The findings of the study will be useful for the policy makers and researchers in planning and developing agronomic and cropping practices as per the shifting conditions so as to minimize the adverse effect of climate to the possible extent. In case such climate trend continues over the next few decades, may have detrimental effects on the agricultural output if climate adaptive strategies are not put in place with top priorities in terms of suitable research and development.

References

- Anonymous. 1992. *United Nations Framework Convention on Climate Change*. United Nation.
- Anonymous, 2012. Fluctuating Temperatures may Hit Wheat Crop. *The Tribune* 4th February: 5
- Dubey, A. 2008. *Carbon footprint of agriculture in Ohio, USA and Punjab India*. M.Sc. Thesis, Ohio State University, Ohio, USA
- IPCC. 2007. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA: 996.
- Lal, M. 2003. Global Climate Change: India's Monsoon and its Variability. *Journal of Environmental Studies and Policy*. **6**: 1-34
- Malla, G. 2008. Climate Change and its Impact on Nepalese Agriculture. *Journal of Agriculture and Environment*. **9**: 62-71
- Rao Prasad, G.S.L.H.V. 2010. *Weather Extremes and Food Security*. Pp. 1-12. PHI Learning Private Limited, New Delhi, India
- Rupa, K.K., Sahai, A.K. Krishna, K.K. Patwardhan, S.K. Mishra, P.K. Revadekhar, J.V., Kamala, K. and Pant, G.B. 2006. High Resolution Climate Change Scenarios' for India for the 21st century. *Current Science*. **90** (3): 334-345

PRODUCTION AND MARKETING RELATED PROBLEMS OF VEGETABLE GROWERS IN PUNJAB

Mini Goyal and Amandeep Singh*

Abstract

The present study was undertaken to study the production and marketing related problems of vegetable growers in Punjab. A sample of total 75 farmers was randomly selected from highest, intermediate and lowest area under vegetables cultivation in the state. It was found that the loss of produce at farm level as well as at the time of marketing was the major problem for the vegetable growers. However, high cost of inputs and services such as labour, seeds and transportation as well as lesser availability of inputs, credit, market information and extension services were some of the problems as reported by the respondents. The marginal and small farmers faced more problems as compared to the large farmers. Interestingly, the vegetable farmers of Ludhiana had faced lesser problems as compared to the farmers of Sangrur and Jalandhar districts. The study advocates effective implementation of regulatory measures, improved market infrastructure and dissemination of market information that could not only improve the production and marketing of vegetables but also the share of the producer in the consumers' rupee.

Introduction

India is the second largest producer of vegetables next to China in the world. The total area under vegetables in 2009-10 was 8011 thousand hectares and its production was 134104 thousand tonnes in the country. The cultivation of vegetables occupies an important place in diversification of agriculture and is most suitable in a country like ours with preponderance of small land holdings, varied climatic conditions and surplus family labour. The state of Punjab shares 2.29 percent area under vegetables and contributes 2.63 percent of the total vegetables produced in the country. The state produced 3522.5 thousand tonnes of veggies in 2009-10 (Anonymous, 2010). The daily requirement of vegetables per person per day is about 300 gm but its availability is less than the half (145 gm) of its requirement only (Salaria and Salaria, 2008). The technique of production, choice of inputs, time of sale, price, produce and

* Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141004

agency through which these are sold were some of the farm decisions which influence production, productivity and net prices received by the farmers for their produce. In other words, the level of profitability of the vegetable crops depends upon how marketing of vegetables is undertaken by the farmers in addition to the technology used in its production. High transport and packing costs, malpractices by middlemen and existence of a large number of intermediaries reduce the producer's share in the consumer's rupee (Garg and Misra, 1976). The producers' share was found to be relatively higher in areas where better infrastructure such as cold storage facilities (Kaul, 1997). There was also massive wastage, deterioration in quality as well as frequent mismatch between demand and supply both spatially and over time (Sharma, 1991). The spectrum of prices from producer to consumer, which is an outcome of demand and supply of transactions between various intermediaries at different levels in the marketing system, is also unique for vegetables. The marketing of vegetables is quite complex and risky due to the perishable nature of the produce, seasonal production and its bulkiness. Moreover, the market infrastructure for food grains is more or less well developed, but for horticultural crops especially fruits and vegetables markets are not that well developed and are congested and unhygienic too (Sharan, 1998). The vegetable growers send their produce daily to these markets for sale and traders and retailers buy them for the consumers. The markets in many of the major cities in the country and Punjab are not covered by market legislation and continue to function under civic body as well as private ownership (Ashturker and Deole, 1985). The efficiency in production and marketing of vegetables has been of significant concern in the recent years (Subbanarasiah, 1991). In the back drop of this the present study was undertaken with the following objectives:

- i. to study the production related problems of vegetable growers,
- ii. to analyze the marketing related problems of vegetable growers in Punjab and
- iii. to give suggestions to overcome production and marketing problems.

Methodology

In order to achieve the stipulated objectives, present study was conducted in Punjab. All the 22 districts in the State were classified into three categories on the basis of area under vegetable cultivation using Cumulative Cube Root Frequency Method (Singh and Mangat 1996). As such Category-I, II and III represented highest, intermediate and lowest district with respect to area under vegetables, respectively. In the next stage Jalandhar, Ludhiana and Sangrur were randomly selected from their

respective categories. At the second stage Phillaur, Ludhiana West and Malerkotla sub-divisions were randomly selected representing the above mentioned districts respectively. A random sample of 25 vegetable growers was taken from each sub-division making a total sample size of 75 vegetable growers. The selected vegetable growers were categorized into marginal (< 1 ha), small (≥ 1 and ≤ 2 ha), medium (> 2 and ≤ 5 ha) and large (> 5 ha) using national farm size classification. The primary data related to their main problems regarding production and marketing of the vegetables were collected from all 75 vegetable growers with the help of specially designed and pre-tested schedule through personal interview method. The data so collected were tabulated and analyzed using simple statistical tools such as percentage, averages, etc.

Results and Discussion

Production related problems

It can be seen from the Table 1 that in Punjab, the loss of vegetables at farm level was found to be the biggest problem for vegetable growers (68 per cent). It was reported by 64, 76 and 64 percent of the respondents in Jalandhar, Ludhiana and Sangrur districts respectively that the major problem was loss of vegetable produce at farm level. It was followed by high cost of labour as reported by 46.67 percent of the vegetable growers at the overall level. Vegetable cultivation is a labour intensive work and its harvesting requires skilled labour. The problem of high cost of labour and the problem of lack of skilled labour in vegetable fields was reported by 40 percent each in Jalandhar, 52 and 28 percent in Ludhiana and 48 percent and 32 percent in Sangrur district, respectively. The problem of high cost of labour and inadequate availability of labour was found to be negatively correlated with the size of vegetable farming in the state. The respective figures for above said components were 58.33 and 66.67, 50 and 43.75, 47.62 and 28.57 and 38.46 and 15.38 percent in the case of marginal, small, medium and large vegetable farmers. Similarly, high cost of seed and lack of quality seed in vegetable cultivation was a bigger problem in marginal farmers as compared to the large ones. The reason may be that the large farmers enjoy economies of scale and might be easily getting seed at low price due to bulk purchase. The problem of high cost of seed as well as low quality seeds was reported by majority of the farmers in Sangrur (80 percent). This was followed by 72 and 56 percent in Jalandhar and Ludhiana districts respectively. In the state as a whole nearly 35 percent of the vegetable cultivators faced the problem of getting

adequate amount of credit. It was reported by 36 percent each in Ludhiana and Sangrur and 32 percent in Jalandhar district.

Table 1: Size wise distribution of production related problems of vegetable growers in Punjab

Problems	Marginal		Small		Medium		Large		Overall	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Jalandhar										
High cost of labour	2	50.00	2	40.00	3	42.86	3	33.33	10	40.00
Lack of skilled labour	3	75.00	3	60.00	2	28.57	2	22.22	10	40.00
High cost seed	2	50.00	2	40.00	3	42.86	3	33.33	10	40.00
Lack of quality seed	2	50.00	2	40.00	2	28.57	2	22.22	8	32.00
Lack of technical information	3	75.00	1	20.00	2	28.57	0	0.00	6	24.00
Lack of extension services	2	50.00	2	40.00	1	14.29	0	0.00	5	20.00
High losses at farm level	3	75.00	3	60.00	5	71.43	5	55.56	16	64.00
Adverse weather	2	50.00	2	40.00	1	14.29	1	11.11	6	24.00
Low availability of credit	3	75.00	2	40.00	2	28.57	1	11.11	8	32.00
Ludhiana										
High cost of labour	3	75.00	3	60.00	4	50.00	3	37.50	13	52.00
Lack of skilled labour	2	50.00	2	40.00	2	25.00	1	12.50	7	28.00
High cost seed	2	50.00	2	40.00	3	37.50	2	25.00	9	36.00
Lack of quality seed	1	25.00	1	20.00	2	25.00	1	12.50	5	20.00
Lack of technical information	0	0.00	1	20.00	0	0.00	0	0.00	1	4.00
Lack of extension services	1	25.00	0	0.00	0	0.00	0	0.00	1	4.00
High losses at farm level	4	100.00	4	80.00	6	75.00	5	62.50	19	76.00
Adverse weather	1	25.00	1	20.00	2	25.00	1	12.50	5	20.00
Low availability of credit	2	50.00	2	40.00	3	37.50	2	25.00	9	36.00
Sangrur										
High cost of labour	2	50.00	3	50.00	3	50.00	4	44.44	12	48.00
Lack of skilled labour	3	75.00	2	33.33	2	33.33	1	11.11	8	32.00
High cost seed	2	50.00	2	33.33	2	33.33	2	22.22	8	32.00
Lack of quality seed	3	75.00	3	50.00	3	50.00	3	33.33	12	48.00
Lack of technical information	2	50.00	3	50.00	3	50.00	2	22.22	10	40.00
Lack of extension services	3	75.00	2	33.33	4	66.67	3	33.33	12	48.00
High losses at farm level	3	75.00	4	66.67	4	66.67	5	55.56	16	64.00
Adverse weather	1	25.00	2	33.33	2	33.33	1	11.11	6	24.00
Low availability of credit	2	50.00	3	50.00	2	33.33	2	22.22	9	36.00
Overall										
High cost of labour	7	58.33	8	50.00	10	47.62	10	38.46	35	46.67
Lack of skilled labour	8	66.67	7	43.75	6	28.57	4	15.38	25	33.33
High cost seed	6	50.00	6	37.50	8	38.10	7	26.92	27	36.00
Lack of quality seed	6	50.00	6	37.50	7	33.33	6	23.08	25	33.33
Lack of technical information	5	41.67	5	31.25	5	23.81	2	7.69	17	22.67
Lack of extension services	6	50.00	4	25.00	5	23.81	3	11.54	18	24.00
High losses at farm level	10	83.33	11	68.75	15	71.43	15	57.69	51	68.00
Adverse weather	4	33.33	5	31.25	5	23.81	3	11.54	17	22.67
Low availability of credit	7	58.33	7	43.75	7	33.33	5	19.23	26	34.67

Nearly 60 percent of the marginal farmers had the problem of availability of credit whereas it was 44, 33 and 20 percent in the case of small, medium and large farmers respectively. Again, exactly half of the marginal farmers reported lack of extension services being available to them whereas only one fourth of small and medium farmers had this problem and in the case of large the figure came out to be 11 percent. Nearly 23 percent of the respondents reported that they had no knowledge of modern technologies used in vegetable farming. Lack of knowledge about modern technologies was the lowest (4 percent) in the case of vegetable farmers of Ludhiana whereas it was comparatively higher in the case of Jalandhar (24 percent) and Sangrur (40 percent) respondents. Similarly, only 4, 20 and 48 percent of the respondents in Ludhiana, Jalandhar and Sangrur faced the problem on account

of non-availability of extension services pertaining to vegetable cultivation. In the absence of use of poly houses or net houses, nearly 23 percent of the respondents reported that they faced the problem of adverse weather conditions in vegetable cultivation.

Market related problems

It can be seen from the Table 2 that the loss of vegetables in the market was the highest problem of vegetable growers (56 percent) at the overall level. Similarly, it was 64 in Sangrur and 52 percent each in Jalandhar and Ludhiana districts of the state.

Table 2: Size wise distribution of market related problems of vegetable growers in Punjab

Problems	Marginal		Small		Medium		Large		Overall	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Jalandhar										
Lack of suitable packaging material	1	25.00	1	20.00	1	14.29	1	11.11	4	16.00
High cost of cold storage	3	75.00	3	60.00	3	42.86	3	33.33	12	48.00
Lack of suitable cold storage facilities	2	50.00	2	40.00	2	28.57	1	11.11	7	28.00
High cost of transportation	3	75.00	3	60.00	3	42.86	3	33.33	12	48.00
Lack of market information	2	50.00	2	40.00	2	28.57	1	11.11	7	28.00
Malpractices by middlemen	3	75.00	3	60.00	2	28.57	1	11.11	9	36.00
Heavy losses in the market	3	75.00	3	60.00	4	57.14	3	33.33	13	52.00
Ludhiana										
Lack of suitable packaging material	1	25.00	1	20.00	1	12.50	0	0.00	3	12.00
High cost of storage	2	50.00	2	40.00	3	37.50	2	25.00	9	36.00
Lack of suitable cold storage facilities	1	25.00	1	20.00	1	12.50	0	0.00	3	12.00
High cost of transportation	2	50.00	2	40.00	3	37.50	2	25.00	9	36.00
Lack of market information	1	25.00	1	20.00	1	12.50	0	0.00	3	12.00
Malpractices by middlemen	1	25.00	2	40.00	2	25.00	1	12.50	6	24.00
Heavy losses in the market	3	75.00	3	60.00	4	50.00	3	37.50	13	52.00
Sangrur										
Lack of suitable packaging material	2	50.00	2	33.33	1	16.67	1	11.11	6	24.00
High cost of storage	3	75.00	4	66.67	3	50.00	4	44.44	14	56.00
Lack of suitable cold storage facilities	2	50.00	2	33.33	1	16.67	1	11.11	6	24.00
High cost of transportation	3	75.00	4	66.67	3	50.00	3	33.33	13	52.00
Lack of market information	3	75.00	4	66.67	3	50.00	3	33.33	13	52.00
Malpractices by middlemen	2	50.00	2	33.33	1	16.67	1	11.11	6	24.00
Heavy losses in the market	3	75.00	4	66.67	4	66.67	5	55.56	16	64.00
Overall										
Lack of suitable packaging material	4	33.33	4	25.00	3	14.29	2	7.69	13	17.33
High cost of storage	8	66.67	9	56.25	9	42.86	9	34.62	35	46.67
Lack of suitable cold storage facilities	5	41.67	5	31.25	4	19.05	2	7.69	16	21.33
High cost of transportation	8	66.67	9	56.25	9	42.86	8	30.77	34	45.33
Lack of market information	6	50.00	7	43.75	6	28.57	4	15.38	23	30.67
Malpractices by middlemen	6	50.00	7	43.75	5	23.81	3	11.54	21	28.00
Heavy losses in the market	9	75.00	10	62.50	12	57.14	11	42.31	42	56.00

The high cost of transportation was a problem as reported by 75, 60, 43 and 33 percent of marginal, small, medium and large farmers in Jalandhar district. The

corresponding figures for Ludhiana were 36, 50, 40, 38 and 25 percent for marginal, small, medium and large farmers. The problem of high cost of cold storage was faced by 56, 48 and 36 percent of the respondents in Sangrur, Jalandhar and Ludhiana, respectively. Lack of market information was one of the major problems which were reported by 52, 48 and 12 percent of the selected vegetable growers of Sangrur, Jalandhar and Ludhiana districts respectively. The lack of market information and regulated vegetable markets generally gives birth to malpractices by middlemen which squeezes the price of the produce when taken to the market and reduces the share of the producer in it. High cost of transportation, storage and heavy margins of middlemen results in a big gap in the farm gate price and retail price. This problem was highlighted by 28 percent of vegetable farmers in the state as a whole. It was 36 percent in Jalandhar and 24 percent each in Ludhiana and Sangrur. Three fourth of the marginal farmers in Jalandhar, half of them in Sangrur and one fourth of the marginal farmers in Ludhiana reported that they had suffered due to malpractices of the middlemen during disposal of produce in the market.

But in the case of large farmers, this problem was reported by only 12.5 percent of the vegetable growers in Ludhiana and 11.11 percent of each in Jalandhar and Sangrur. The high cost of cold storage was a problem in the case of 67 56, 43 and 35 percent of marginal, small, medium and large farmers respectively in the state. Inadequate availability of packing materials was a hindrance in marketing of the produce in the case of 24 percent in Sangrur, 16 percent in Jalandhar and only 12 percent of vegetable growers in Ludhiana. Almost all the vegetable growers taken under study complained about the problem of price fluctuations in the vegetables especially at the time of glut in the market.

Conclusions

Based on the above discussion it can be inferred that the vegetable growers irrespective of size of area allocated to vegetables had faced a number of problems relating to production and marketing of vegetables in Punjab. The marginal and small farmers faced more problems as compared to the large farmers. It was noticed that the vegetable farmers of Ludhiana faced lesser problems as compared to their counterparts in other districts as they can get the technical advice from the experts at Punjab Agricultural University on production and marketing related matters easily where as farmers of other sample districts do not have such privilege. As the vegetable growers had reported about the problem of lack of suitable cold storage facilities, hence, the government should provide cold storage facility to the vegetable

growers at right time and at reasonable cost. The supply of suitable packaging materials is another requirement for safe disposal and to reduce post-harvest losses. The packaging material like plastic crates, gunny bags and polythenes should easily be made available for vegetables at low cost according to the requirements of the farmers to transport their produce in the distant markets. In order to increase the profits of farmers, the transportation cost can be reduced by providing subsidy on transportation operations. In order to overcome vegetable seeds related problems the government should ensure supply of quality seeds to the vegetable growers. The private seed companies should be regulated and the price determination of the seeds should be in government's control. As vegetable farming is a labour intensive occupation so required skilled manpower for various operations like nursery raising, transplanting, sowing, weeding and harvesting of vegetables, etc. so labour should be technically trained. The skilled manpower can be generated by providing short-term training courses to the vegetable growers and farm labour regarding vegetable cultivation techniques.

To provide day to day market information like price of vegetables in different markets to vegetable growers, the government should facilitate information to growers through village panchayats, pamphlets or any other efficient media. A separate TV channel exclusively meant for farm, farming and farmers can be a big step in this regard. The study advocates effective implementation of regulatory measures, improved market infrastructure and dissemination of market information that could not only improve the production and marketing of vegetables but also the share of producers' in consumers' rupee.

References

- Anonymous. 2010. *Agricultural Statistics at a Glance*, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi
- Ashturker, B.M. and Deole, C.D. 1985. Producers' share in consumers' rupee: A case study of fruit marketing in Marathwada. *Indian Journal of Agricultural Economics*. **3**: 40.
- Garg, J. S. and Misra, J.P. 1976. Costs and margins in the marketing of vegetables in Kanpur. *Agricultural Marketing*. **8** (2):36.
- Kaul, G.L. 1997. Horticulture in India: Production, marketing and processing. *Indian Journal of Agricultural Economics*. **3**: 52.
- Salaria, A.S. and Salaria, B.S. 2008. *Horticulture at a Glance*. Jain Brothers. New Delhi: 7.
- Sharan, G. 1998. *An operational study of the CJ Patel vegetable and fruit market of Ahmedabad*. **Research Report**. Indian Institute of Ahmedabad, Gujarat.
- Sharma, K. 1991. *Marketing Management of Horticulture Produce*, Deep & Deep Publications, New Delhi.

- Singh, R. and Mangat, N.S. 1996. *Elements of Survey Sampling*. Kluwer Academic Publishers, London: 135-136.
- Subbanarasiah, N. 1991. *Marketing of Horticultural Crops in India*. Anmol Publishing Co., Delhi.

ETIOLOGY OF RURAL EXCLUSION IN HIGHER EDUCATION: A CASE OF PUNJAB

Simran Kang Sidhu and Shalini Sharma *

Abstract

The Indian education sector witnessed phenomenal changes during the last decade. The most noticeable development occurred in the sphere of higher education. Presently, there are eleven universities, 232 general colleges and 475 professional colleges in Punjab as compared to 1991, when there were only four universities and 199 professional colleges. The number of students in these institutions has increased. Today, 318301 students are enrolled in higher education. However, it is unfortunate that rural students are not visible in these institutions. The present paper is an attempt to identify factors responsible for the rural exclusion in higher education. The findings are based on the secondary data as well as the group discussions with villagers of Ludhiana district. The poor quality of education and hefty fee structure of higher educational institutes emerged as the main factors of rural exclusion in higher education while other factors are only the upshots of the main factors. It is suggested that improvement in the school education system by bringing about some structural changes as well as revisiting the policy for higher education is must for the inclusion of rural students in higher education.

Introduction

Education is a corner stone of economic and social development. In the developing countries like India, the largest resource that it can command at any given time is man power. Moreover, the adults who have higher level of education attainment have more and better paid employment, higher individual earnings and higher social standing than those who have lower educational attainment. Planners and policy makers in independent India have looked upon education as one of the principal instrument of development. The extent and the depth of their faith in education may be gauged in the national constitution which promised free and compulsory education to all children up to the age of fourteen. To fulfill this

* Associate Professors of Sociology, Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141004 Email: simransidhupau@gmail.com

objective the government established a vast network of primary and secondary educational institutions in the country.

Table 1: Higher educational institutions (HEIs) in Punjab

Higher Education		1991	2001	2007
Number of HEIs	<i>Universities</i>	4	5	11
	<i>Professional Colleges</i>	199	307	475
Number of Students in HEIs	-	-	233745	318301
Percent of Rural Students in HEIs	<i>Universities</i>			4.00
	<i>Professional Colleges</i>			3.70

Source: Brar and Kalia (2009)

As a result the literacy rates increased significantly from 16.6 percent in 1955 to 74 percent in 2011. In the same way higher education sector also expanded significantly particularly in the last two decades. The emergence of liberal economic policy environment resulted in observable changes in the sphere of higher education in the form of entrance of private sector in education. Like other states of the country, Punjab too experienced the proliferation of higher educational institutions (Ghuman, 2009). Private players entered in higher education in a decisive way and the central bodies of the universities nodded to the self supporting professional courses in universities. As a result the strength of higher education suppliers increased substantially.

Today there are eleven universities including two deemed universities and 524 professional colleges affiliated to these universities in the State as compared to 1991, when there were only four Universities and 199 professional colleges. The number of students in these institutions has increased overtime. Today, 318301 students are enrolled in higher education (Table 1). Unfortunately, rural students are missing in these institutions. The percentage of rural population in the state is 66 percent where as the share of rural students in the four main universities and professional institutes in the state is only 3.71 percent (Ghuman *et al.*, 2008). According to a census study of fifty villages in Punjab, 12 percent of the rural population was above school level, out of which only 3 percent were post-graduates (Singh *et al.*, 2011). It indicates a clear cut exclusion of rural students in higher education in the state.

So far as the Government school education is concerned, the statistics display an improving trend in its three components vis-à-vis literacy, enrolments and

dropouts. The rural literacy has increased by 25 points from 52.7 percent in 1991 to 77 percent in 2011 (Census 2011). The dropout rates particularly at primary level have fallen from 22.17 percent in 2000 to 9.9 percent in 2007 implying that today 90 percent of the students enrolled for primary level set out for further education. At the same time it is ironic to note that 46.4 percent of students drop out at high level (Table 2). Why these students dropout and cannot go beyond school level education is a matter of great concern. Keeping these facts in view the present paper is an attempt to examine the factors responsible for exclusion of rural students in higher education.

Table 2: Level wise dropout rates in Punjab

Education Level	1999-2000			2006-07		
	Boys	Girls	Total	Boys	Girls	Total
Primary	24.12	19.99	22.17	14.21	4.92	9.90
Middle	29.82	29.90	29.85	29.30	30.54	29.87
High	35.37	35.73	35.54	43.88	49.40	46.48

Source: Anonymous, 2009-10.

Methodology

The data base for the study is six villages of Ludhiana district namely Adda Dakha, Aayali, Baddowal, Barewal, Pamal and Sunet purposively selected for easy accessibility. The findings of the study are based on the group discussions with the adult educated (Matric and above) villagers as well as the teachers of rural government schools of the selected villages. The propositions are supported by the data taken from various empirical studies conducted by the social scientists in the region.

Results and Discussion

The main factors responsible for the rural exclusion in higher education are as under:

Poor quality of education in rural schools

Today everyone in the country, irrespective of caste, class, region and religion has acknowledged the role of education in the development of self as well as of the community. However, the quality of education in government schools, particularly in rural areas is so poor that the people in general have lost faith in the education system itself. It is believed that education imparted in rural schools is worthless and takes students to nowhere.

However, it was not like that in the past. Until 1980, the standards of education in government schools were highly satisfactory. Ninety nine percent of the rural students in Punjab were enrolled in government schools. Most of the top leaders, bureaucrats, doctors, engineers and academicians of higher rank today had had their school level education (some thirty years back) from rural schools. Majority of the adult population at that time either witnessed or took part in *Struggle for Independence*. They had a strong faith in the newly found democracy and government policies which enabled the Punjab state to acquire the title of *Feeding Bowl of India*. The teachers were dedicated and parents had full faith in public education system. But then in eighties, came the era of militancy. The decade long atmosphere of aggression and terror crumbled the development process in the state. The whole government machinery was engaged in tackling the problem of militancy. In the process, the other public sectors were ignored and education was taken a backseat. The percentage of budget allocation to education had shrunk from 22.17 percent in 1970 to 12.33 percent in 1991 (Gill *et al.*, 2005). It adversely affected the quality of education in government schools. Furthermore, the terror stricken villages justified the absenteeism on the part of teachers as well as the students in schools. To meet the expectations of *National Literacy Mission* for high pass percentage in the schools and to justify their employment status, the officials and teachers not only ignored but also became a party the use of unfair means in the examinations conducted by the Punjab State Education Board (PSEB) which ultimately spiraled into mass-copying. The occasional incidences of absenteeism, cheating and copying in examinations turned into a habit and ultimately a tradition. In the course of time, almost all, related to education (officials, teachers and students) got tainted and lost their credibility.

At the macro level rural Punjab presents a very promising picture in education. Out of total number of 19800 schools, 86.5 percent are in rural areas. Practically every village has a primary school, a middle school within two kilometers and a senior secondary school within seven kilometers. Out of nearly forty lakh school children, 80 percent attend government schools (Singh, 2008). But at the micro level, it has been observed that no less than three fourth of the children who joined government schools, dropout by the time they reach senior secondary level. One half of those students who appear in matriculation examination as regular student, fail to pass. Great gaps are observed between the actual marks obtained by the students and the marks obtained by them in PSEB examinations. A study conducted to check quality of education in the selected rural schools revealed that out of 1180 Primary (5th Standard) passed students who had successfully cleared the

examination conducted by PSEB in 2004, 66 percent failed in the test conducted by the investigator where as the pass percentage in the selected schools was as high as 98 percent per school that year (Sidhu and Singh, 2005). The availability of physical facilities in the schools is an important indicator of quality of education. Out of the total 12972 primary schools, 35 percent are short of class rooms, 66 percent lack proper mats for students, 34 percent are without electricity, 26 percent do not have toilets and 30 percent have no boundary wall (Singh, 2008). The teachers on the payroll of schools are not motivated enough to teach in schools. On any given working day, 25 percent of the teachers are absent from the schools. Those present are not interested in teaching. Out of standard 180 teaching days in an academic session, on an average for 73 days the teachers are put on non academic duties such as preparing voters lists, election duties, census recording, etc. It adversely affects quality of teaching and performance of students in the examinations (Sidhu and Singh, 2005). *The Education Policy 2002: Programme of Action* itself indicates that the government is aware of the gravity of the existing affairs. Consequently the infrastructure was strengthened by providing funds for rural schools through Panchayats. The up-gradation of quantity and quality of teaching was made by recruitment of teachers on contract basis and by creating special teams at district level to monitor the school education. Setting up of Adarsh Schools in rural areas for poor and intelligent students is a positive step towards *inclusion* in rural areas. Even efforts by the managements of a few private institutes and the universities for reserving seats for rural students in professional courses are commendable. It definitely exhibits their concern, but seems futile due to the high magnitude of the problem. However, not much improvement has been observed in the performance of students till date.

Competitive Examinations

Some rural students who somehow managed to pass or even get good marks in the matric or senior secondary classes find themselves at loss in the competitive examinations conducted by the various professional institutes and universities to admit students in higher education. The mushrooming of coaching centers in urban cities, with highly professional approach and tailored programmes is another parallel system available to students seeking admissions in professional courses. Joining these coaching institutes is considered a prerequisite for entering into higher education even by the urban students of reputed schools. Nevertheless, availing coaching in these institutes remains a distant dream for rural students due to high costs and lack of physical proximity.

Poor economic condition of the farmers

The poor economic condition of the farmers is another reason for the rural students to leave studies after school education. According to the estimates of Punjab Government, 73 percent of the households in rural areas belong to farming community out of which 62 percent are small, marginal and semi-medium farmers (Brar and Kalia, 2009). At the present stage, when the viability of agriculture is a question mark and the rate of farmer suicides due to indebtedness is on the high, sparing money for higher education even for a single child in the family is beyond the capacity of majority of the households in rural areas.

Liberalization policy

The liberalization policy is also responsible for rural exclusion in higher education. There is hegemony of profiteering ideology in liberalization. Every sector of economy is under its spell. Various studies have indicated that in term of profit education and health are the two sectors that have gained the highest. The private investment in education has come in a big way. The professional courses in private institutes and self supporting programmes in the universities remain in-accessible to rural masses due to their profit oriented hefty fee structure.

Another upshot of liberalization is the increasing trend of seeking immigration to western countries. In the wake of globalization and liberalization policy, the human resource mobilization has occurred liberally across nations and Punjabi youth, particularly from rural areas, tries all possible legal and illegal means to migrate to foreign lands particularly to the west. It is a general notion upheld by the majority that no matter how much one is qualified he has to start afresh there. Accordingly, in the hope of settling abroad, majority of the aspirants leave their studies and do not set out for higher studies. They idle and just wait for the right opportunity and avenues such as work, study or marriage to immigrate to the West.

Alcoholism and drug addiction

Drug addiction is both, cause and effect of keeping rural youth out of higher education domain. It has hooked up rural youth in its clutches. A survey conducted by the Department of Social Security Development of Women and Children reported that in Punjab, 75 percent of the rural adult male population is alcoholic and 67 percent of the rural households have at least one drug addict (Singh 2008). The government admitted that the entire Punjab is in the grip of a drug hurricane that has weakened the morale, physique and character of the youth. A study conducted by *World Health Organization* has pointed to a sharp increase of infertility among Punjabi males and attributed it to drug abuse and alcoholism. Drug addiction is not only affecting adversely the health of Punjabi youth but also their chances of

education and employment (Anonymous, 2010). Some of the reasons for high incidence of alcoholism and drug addiction in rural areas are disguised unemployment, idleness, dejection and hopelessness which themselves are the outcome of lower level of education. An easy availability and access to drugs is another cause of such rampant use of substance in the state. The chemist shops in villages, which are meant to be the lifeline for the villagers, are one of the major sources of illegal drugs for the villagers. The adolescents, ones hooked up by drugs end up as addicts. The state is in the danger of losing of its young generation.

Conclusions

The poor quality of education and hefty fee structure of higher educational institutes emerged as the main factors of rural exclusion in higher education while other factors are only the upshots of the main factors. It is high time that administrators, policy makers, academicians and intellectuals come together to address the situation in earnest and formulate some action plan to include the otherwise potential rural youth in the development process where education is a pre-requisite. The foremost task before government is to bring about some structural changes in the education system itself. It is purposed that a well equipped government higher secondary school with all the modern teaching techniques and optimal teacher pupil ratio should be established at the central place (may be at block level) catering to the needs of ten to twelve villages. All the primary schools should be under the supervision of this very school. The private schools may also be included in the process by fixing quota in these schools as well as providing funds from public expenditure funds. *Secondly* rural students should be provided with loans for education on priority through public sector banks at lower interest rate. *Thirdly* the employment opportunities should be created for the skilled rural youth by establishing agro-based industries in rural areas and by encouraging self employment through loans and training programmes. *Fourthly* there is an urgent need to control the illegal sale of the un-prescribed medicines/drugs. Stern action should be taken against the defaulters. *Lastly* the state universities can play a very positive role in inspiring the rural students for higher education. Consultancy camps may be organized in rural areas where the university students participate in motivating school students towards higher education by making them aware regarding various professional courses and becoming their role models as well.

References

- Anonymous. 2009-2010. *Economic Survey*. Economic and Statistical Organization, Government of Punjab, Chandigarh: 95-100.
- Anonymous. 2010. *The Tribune*, Chandigarh. 04 October.
- Brar, J.S. and Kalia, S. 2009. Market Driven Higher Education sector in Punjab. *Man and Development*. **3** (4): 51-66.
- Census of India. 1991-2011. *Provisional Population Totals*. Government of India. New Delhi.
- Ghuman, G.S. 2009. Higher Education in Punjab. *Journal of Social Sciences*. **7** (1): 5-13.
- Ghuman, R.S., Singh, S. and Brar, J. S. 2008. *Professional Education in Punjab: Exclusion of Rural Students*. **Project Report**. Department of Economics, Punjabi University, Patiala.
- Gill, S.S., Singh, S. and Brar, J.S 2005. Educational Development, Public Expenditure and Financing of Secondary Education in Punjab. *Journal of Educational Planning and Administration*. **19** (2): 335-374
- Sidhu, S. and Singh, H. 2005. Quality of Elementary Education in Rural Punjab: An overview. *Guru Nanak Journal of Sociology*. **26** (1): 59-72.
- Singh, B. 2008. *Alarming Statistics* culled from <http://www.dise.in/downloads>.
- Singh, K., Sidhu, R.S. Singh, S., Sidhu, S.K., Singh, B. and Romana, G.S. 2011. *Status of Rural Education in Punjab*. **Project Report**. Punjab Farmers' Commission, Government of Punjab and PAU, Ludhiana.

IMPACT OF BORDER AREA DEVELOPMENT PROGRAMME ON INFRASTRUCTURE IMPROVEMENT IN PUNJAB

Amandeep Singh and B.S.Tiwana *

Abstract

Under this Border Area Development Programme (BADP) the Government of India approves the work under six sectors namely infrastructure, education, health, agriculture, allied agriculture, social and security related works. The available statistics show that the development of the area has not shown desired results in spite of the government has provided liberal grants during the study period. The lack of education, health, infrastructure development, veterinary facility, professional and job oriented courses, industrial development, etc. is still lagging behind the envisaged targets. It was observed that the various development plans were prepared without the participation of real stakeholders. This calls for the participation of the all the stockholders in the planning, preparation and implementation of the various development programmes keeping in view the requirements and expectations of the people of the border area. It is suggested that political interference should be eliminated and the comprehensive plan for border area be prepared at least 10 years in advance for the creation of suitable and adequate infrastructures for the overall development of the border area.

Introduction

Punjab is a prosperous agricultural state with 553 km long international border with Pakistan. The border districts of Gurdaspur, Ferozepur, Tarn Taran and Amritsar were economically more advanced at the time of independence but lagged behind over time due to their proximity to the border and long spell of cross-border terrorism. Farmers living in the border areas face many problems, which restrict their income growth due to lot of restrictions on their economic activities and usual flooding of their fields by the rivers and seasonal water bodies.

Punjab has a special place in India due to its geographical conditions. The total border area of the state is 6197.21 square km out of total state area of 50362

* Ph.D. *Scholar* and Professor of Economics respectively, Department of Economics, Punjabi University, Patiala and, Department of Economics, Punjabi University, Patiala-147002

square km with population of approximately 20 lakhs thereby making its share of about 8 per cent in the total population (Anonymous, 2010). The Government of India has been implementing a number of Centrally Sponsored Schemes but there is only one scheme which has been launched specifically for the development of border area known as Border Area Development Programme (BADP) with the objective of building the much needed social and physical infrastructure to propel normal development activities and to enhance household incomes to promote economic growth.

The BADP was introduced in the Seventh Five Year Plan as a Centrally Sponsored Scheme (CSS). The BADP is to be seen as a Central Government intervention strategy to bring about a balanced development of border areas which encounter area-specific problems like inaccessibility, remoteness, sense of insecurity arising out of threat perception from external aggression, cross-border terrorism, unlawful activities, etc. Originally, the programme was to be implemented in Western Border States under the administrative control of the Ministry of Home Affairs with an emphasis on development of infrastructure to facilitate deployment of Border Security Force.

As per guidelines, the concerned state governments are required to conduct 'need assessment' surveys of border areas to identify and formulate specific schemes in the broad areas of concern of the BADP. The programme lays emphasis on development of social and economic infrastructure, law and order, promotion of people's participation in development, elimination of the sense of alienation and insecurity from the minds of people, so as to create conditions conducive to social and economic progress. The annual allocation under the BADP was not very high (less than ` 100 crores in 1996-97). The scheme was designed to be implemented in the identified border blocks (units of planning) through the state governments. The funds available under the programme were used only in identified blocks for creation of durable assets.

Earlier impact evaluation studies on the BADP have reported that between 1991 and 1997, a change in the occupational pattern has been observed in border areas. Except for Punjab, the proportion of principal earners in agriculture shows a decline, while that in non-agriculture has risen. Most of the earners have shifted to petty trade and household industries. The present study was planned with the following specific objectives:

- i. to examine the availability and utilization pattern of funds received under Border Area Development Programme in border areas of Punjab and

- ii. to evaluate the impact of Border Area Development Programme on the infrastructure development in border areas of Punjab.

Methodology

The nature of the study was such that it required both primary as well as secondary data. The secondary data were obtained from various published sources on various aspects of the BADP. As such, most of the secondary data were collected from the Punjab Governments' official website. A multistage sampling technique was employed to reach out the ultimate sampling units. At the first stage all four border districts were chosen purposively. At the next stage two blocks from each sample district were chosen randomly. At the third stage two villages each were chosen randomly from each sample block. At the last stage 10 respondents belonging to different socio-economic group were selected randomly from each village and thus, making a sample of 160 respondents. The detail of which summarized in below:

Districts	Blocks	Villages	Sample respondents
Amritsar	Ajnala, Chogawan	Panj Garai Wala, Nawan Pind, Dhariwal and Bachiwind.	40
Taran Tarn	Bhikhiwind , Valtoha	Theh Kala, Narli, Ram Singh Wala and Valtoha.	40
Gurdaspur	Dera Baba Nanak , Kalanaur	Shakri, Shampura, Ali Sher and Kalanaur	40
Ferozepur	Ferozepur, Guru Har Sahai	Kamalwala, Ghati Rahimke, Bahadurke and Jandwala.	40
Total	8	16	160

The requisite primary data pertaining to various aspects of border area development programme and their perception about it were collected through personal interview method on pre-tested schedule. The data were analysed by using simple statistical tools such as averages, percentages, etc.

Results and Discussion

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

District-wise availability of funds

Under BADP four districts of Punjab namely Amritsar, Ferozepur, Gurdaspur and Tarn Taran are covered. The funds were released by Government of

India on 100 percent Central Share basis. It has been observed that Ferozepur district received highest funds under the scheme and the Amritsar district got the lowest. The perusal of Table 1 indicates that since financial year 2004-05 Ferozepur district has received `5179.97 lakhs, where as Amritsar district has received only `1678.29 lakhs. Other districts namely; Gurdaspur and Tarn Taran received `2621.03 and `2003.20 lakhs, respectively.

Table 1: District-wise availability of funds under BADP

Year	Amritsar	Ferozepur	Gurdaspur	Tarn Taran	Total
2004-05	139.39	433.94	232.40	156.76	962.49
2005-06	110.16	466.54	208.01	173.29	958.00
2006-07	133.98	484.83	247.41	194.78	1061.00
2007-08	257.53	839.03	427.72	345.72	1870.00
2008-09	305.46	995.16	507.32	410.06	2218.00
2009-10	301.33	981.69	500.48	404.50	2188.00
2010-11	430.44	978.78	497.69	318.09	2225.00
Total	1678.29	5179.97	2621.03	2003.20	11482.49

Source: www.pbplanning.gov.in

Sector-wise availability of funds

The funds were released for various developmental works under the BADP. This centrally sponsored approved the work under six sectors namely Infrastructure, Education, Health, Agriculture, Allied agriculture, Social and Security related works. The perusal of Table 2 exhibited that the sector-wise funds utilization in selected border districts of Punjab from financial year 2004-05 to 2010-11. The results indicate that out of the funds received under the BADP 81.96 percent were expended on the development of infrastructure in Tarn Taran district. The corresponding figures for Amritsar, Ferozepur and Gurdaspur were found out to be 73.21, 66.31 and 78.74 percent respectively. In the case of education the amount released came out to be 8.52, 5.95, 3.47 and 3.04 percent in Amritsar, Ferozepur, Gurdaspur and Tarn Taran district, respectively. The respective figures for amount released for health were estimated to be 2.48, 0.77, 1.25 and 0.44 percent in the above said districts respectively. It was observed that 8.43 percent of the money received during the period under reference was expended on agriculture and allied agriculture in

Gurdaspur district. This was followed by Tarn Taran, Ferozepur and Amritsar with 3.46, 3.04 and 2.65 percent respectively.

The data presented in Table 2 revealed that 15.71, 5.63, 3.98 and 1.70 percent of the funds received during the period 2004-05 through 2010-11 was expended on the creation of social infrastructure in the villages in Ferozepur, Amritsar, Tarn Taran and Gurdaspur respectively. It was found that 8.2 percent of the funds were expended on the security for the guarding the international border in Ferozepur district. This was followed by Amritsar (7.51 %), Tarn Taran (7.12%), and Gurdaspur (6.48 %) respectively. Above discussion shows that the major portion of the funds received under the BADP were expended on the development of infrastructure in all the border districts of Punjab.

Table 2: Sector-wise availability and utilization of funds received under BADP in districts of Punjab, 2004-05 through 2010-11

Name of Sector	(Lakhs)			
	Amritsar	Ferozepur	Gurdaspur	Tarn Taran
Infrastructure	1144.62 (73.21)	1124.18 (66.31)	778.51 (78.74)	1115.02 (81.96)
Education	133.06 (8.52)	100.84 (5.95)	34.35 (3.47)	41.34 (3.04)
Health	38.80 (2.48)	13.00 (0.77)	12.37 (1.25)	6.00 (0.44)
Agriculture and Allied agriculture	41.50 (2.65)	51.51 (3.04)	83.32 (8.43)	47.09 (3.46)
Social infrastructure	87.95 (5.63)	266.23 (15.71)	16.80 (1.70)	54.15 (3.98)
Security	117.46 (7.51)	139.42 (8.22)	63.40 (6.41)	96.90 (7.12)
Total	1563.39 (100)	1695.18 (100)	988.75 (100)	1360.50 (100)

Source: www.pbplanning.gov.in

Figures in parentheses are percentages to the total

Under this sector the main works were construction of streets and drains, construction of ways to *deras*, construction of *phirnis*, etc. As such no major infrastructure like setting up of industrial plants or big projects of long term utility was created. The stress has been given only to small developmental works which otherwise could have been undertaken other normal developmental schemes of the

Punjab government. Similarly, under education, health, agriculture and social sectors only small works have been carried out. It was noticed that no big hospital or veterinary centre or old age home, etc. were established from the funds received under the BADP. As far as security sector was concerned some funds have been utilized to meet the minor demands of BSF authorities concerning security.

Impact of BADP on infrastructure development of selected border villages

In the present study an attempt was made to examine the development of infrastructure in the selected border villages of the state. Although, the BADP has been operational in the Punjab since Seventh Five Year Plan in spite of this the border villages are still lacking basic infrastructure facilities. The perusal of Table 3 shows that all the sample villages have *anganwadis* for pre-schooling kids and primary schools but facilities after primary education is not satisfactory. It has been observed that only 25 percent each of the selected villages have middle school in Ferozepur and Gurdaspur districts. Similarly, 25 percent each of the sample villages in Amritsar and Gurdaspur have the secondary schools. The figure for Tarn Taran was estimated to be 50 percent. It has also been observed that none of the selected villages have either ITIs, polytechnic colleges or other professional institutes. This indicates a very poor educational infrastructure scenario in the study area of Punjab.

Table 3: Basic education infrastructure availability in border villages

Name of District/Block	Anganwadi Centre	Primary School	Middle School	Secondary School	Sample villages (No.)
Amritsar	4 (100.00)	4 (100.00)	-	1 (25.00)	4 (100.00)
Ferozepur	4 (100.00)	4 (100.00)	1 (25.00)	-	4 (100.00)
Gurdaspur	4 (100.00)	4 (100.00)	1 (25.00)	1 (25.00)	4 (100.00)
Tarn Taran	4 (100.00)	4 (100.00)	-	2 (50.00)	4 (100.00)

Source: Field Survey

Figures in parentheses are percentages to total number in each district.

Status of basic health, veterinary and potable water facilities in border villages

Similarly present study has attempted to examine the availability of basic health, veterinary and potable water infrastructure facilities in the border areas. The perusal of Table 4 shows that there is poor state of affairs as far as health infrastructure in border areas was concerned. It seems that people are left to the

mercy of God as there are only 6.25 percent each of the selected villages of Amritsar, Ferozepur and Gurdaspur districts and 12.50 percent villages of Tarn Taran district have either a hospital or dispensary. At the overall level 31.25 percent of the villages have medical facilities.

It has also been observed that animals have also been suffering from poor veterinary health facilities in the sample villages. Out of the selected border villages only 6.25 percent each of border villages of Amritsar and Gurdaspur were having either a veterinary hospital or dispensary. The figure for Tarn Taran district was estimated to be 12.50 percent. The situation seems worst in Ferozepur district it has no veterinary hospital or dispensary to look after the ailing cattle in the sample villages.

Table 4 Availability of basic health, veterinary and drinking water facilities in border villages

Name of District/Block	Hospital/Dispensary	Veterinary Hospital / Dispensary	Drinking water Supply			Water Supply Tank
			Yes	No	Partial	
Amritsar	1 (6.25)	1 (6.25)	-	2 (12.50)	2 (12.50)	1 (6.25)
Ferozepur	1 (6.25)	-	-	1 (6.25)	3 (18.75)	1 (6.25)
Gurdaspur	1 (6.25)	1 (6.25)	-	3 (18.75)	1 (6.25)	1 (6.25)
Tarn Taran	2 (12.50)	2 (12.50)	1 (6.25)	-	3 (18.75)	2 (12.50)
Overall	5 (31.25)	4 (25.00)	1 (6.25)	6 (37.50)	9 (56.25)	5 (31.25)
Total number of villages	16 (100)	16 (100)	16 (100)	16 (100)	16 (100)	16 (100)

Source: Field Survey

Figures in parentheses are percent to the total

During present study one more surprising fact came to light that only 6.25 percent of border villages were having potable water supply. It was noticed that at the overall level 37.50 percent of the villages were having no potable water supply. The split up of the data further revealed that 18.75, 12.50 and 6.25 percent of the villages do not have the potable water supply. It was noticed that 56.25 percent of the villages were having partial water supply. The results revealed that the Tarn Taran and Ferozepur districts were worst hit as far as potable water supply was concerned in the

sample villages (18.75 percent). The water supply was partial in 12.50 and 6.25 percent of the villages in Amritsar and Gurdaspur. It was noticed that 12.50 percent of the villages in Tarn Taran have water supply tank. The figure for Amritsar, Ferozpur and Gurdaspur were estimated to be 6.25 percent. The overall figure was estimated to be 31.25 percent of the villages having water storage tanks. It has also been observed that majority of border residents have acquired serious diseases which were mainly caused by non-availability of adequate potable water. A majority of them are suffering from jaundice, cancer and others water borne diseases.

Industrial units in the border areas

The Punjab Government is trying to give new heights to industrial growth in the State. The industry is most important sector of any economy as on one hand it provides stability to state exchequer and on the other hand it provides employment opportunities to the people. In the present study an attempt has been made to examine the growth of industrial scenario in the border areas of Punjab. It can be seen from Table 5 that there is not even a single big industry in the selected border villages. Only industry available in the sample villages is either cottage industry or very small scale industry. In the entire selected border villages of the state there are only 31 cottage industries which consisted of *papad* making, *khadies*, etc. It was noticed that the Tarn Taran district was having highest cottage industrial units (23) in the selected border villages where as there was no cottage industrial unit in selected villages of Gurdaspur district. The data presented in Table 5 show that there are only 17 small scale industrial units in the selected villages of sample districts.

Table 5 Industrial units in the border areas

Name of District/ Block	Cottage industrial Units	Small Scale Industrial Units
Amritsar	5	2
Ferozpur	3	1
Gurdaspur	0	12
Tarn Taran	23	2
Total	31	17

Source: *Field Survey*

It was noticed that the Gurdaspur district was having highest small scale industrial units (12) where as in Ferozpur district there was only one small scale industrial unit. The corresponding figures for Amritsar and Tarn Taran districts were came out to be two units each. The available small scale industrial units are those which have very low level of investment and employment such as small rice shelling

mills, brick kilns or flour mills, etc. This shows that although there are a number of development schemes being run by the government but even then it could not have any favourable impact on the establishment of new industrial units in the border areas of the state.

Decision making process for planning and implementation of BADP

It has been observed that concerned gram panchayats are not taken in confidence while formulating the development plans under the BADP. The perusal of Table 6 shows that concerned gram panchayats as well as district administration are not involved in the decision making process for selecting the developmental works under the BADP. It was reported by 80.62 percent of the respondents that the proposals for development works were finalized by the sitting MLAs for the sample villages of the study area in Punjab. Similarly, 10 percent of the respondents are of the view that developments were suggested by MPs while 9.38 percent of the respondents informed that other prominent persons of the area suggested the development proposal for study area.

Table 6: Participation in decision making process for BADP works by different interest-groups in Punjab

District	MLAs	MPs	Others	TOTAL
Amritsar	25 (62.50)	-	15 (37.50)	40 (100)
Ferozepur	24 (60)	16 (40)	-	40 (100)
Gurdaspur	40 (100)	-	-	40 (100)
Tarn Taran	40 (100)	-	-	40 (100)
Total	129 (80.62)	16 (10)	15 (9.38)	160 (100)

Figures in parentheses are percentages to the total.

Source: Field Survey

The split up of the data showed that 62.50 and 37.50 percent of the respondents of Amritsar district reported that the development works are suggested by sitting MLAs and other prominent persons respectively of the area. In Ferozepur district 60 and 40 percent of the respondents reported that the development proposals were formulated on the behest of MLAs and MPs respectively. In Gurdaspur and Tarn Taran districts 100 percent of the respondents are of the view that the development proposals were suggested by the sitting MLAs. So it shows that only

representatives of ruling party decide the works to be undertaken under BADP. Hence, it can be concluded that the implementation of the BADP in the border areas of Punjab is totally politically driven and in the process of selection of development works are not as per the wishes of various stake holders of the study area.

Opinion of respondents pertaining to implementation of development works

The data presented in Table 7 revealed that 74.38 percent respondents of the border area wish that the proposals for various development works be taken with the consent of concerned gram panchayats. It has been observed that 16.25 percent respondents feel that district administration should make the development plan of their villages. Some residents still feel that proposals should be taken from MLAs, MPs and other local politicians.

Table 7: Peoples Willingness about Decision Taking of Development Works under BADP Schemes

District	MLAs	MPs	Administration	Gram Panchayats	Others	TOTAL
Amritsar	5 (12.50)	-	10 (25)	20 (50)	5 (12.50)	40 (100)
Ferozepur	3 (7.50)	2 (5)	5 (12.50)	30 (75)	-	40 (100)
Gurdaspur	-	-	5 (12.50)	35 (87.50)	-	40 (100)
Tarn Taran	-	-	6 (15)	34 (85)	-	40 (100)
Total	8 (5.00)	2 (1.25)	26 (16.25)	119 (74.38)	5 (3.12)	160 (100)

Figures in parentheses are percentages to the total.

Source: Field Survey

It was noticed that 50, 25, 12.50 and 12.50 percent respondents are of the opinion that development works may be finalized by the gram panchayats, administration, MLAs and other in Amritsar district respectively. In Ferozepur district 7.50, 5.00, 12.50 and 75.00 percent people feel that development works be finalized by the MLAs, MPs, administration and gram Panchayats respectively. In Gurdaspur district 12.50 and 87.50 percent of the respondents were of the view that development works be finalized by the administration and gram panchayats respectively. The corresponding figure for Tarn Taran district were estimated to be 15 and 85 percent respectively as per as the preparation and implementation of development works were concerned. It shows that people of the border area have

diverse opinion regarding decision making process for the preparation, planning and implementation of various developmental works in the border area.

Conclusions

The Border Area Development Programme is a very good programme and it has very good potential for overall development of border areas. However, available statistics show that the development of the area has not shown desired results. The lack of education, medical facility, veterinary facility, infrastructure development, professional job oriented courses, industrial development, etc. is still lagging behind the envisaged targets. It was observed that the various development plans were prepared without the participation of real stakeholders. This calls for the participation of the all the stockholders in the planning, preparation and implementation of the various development programmes keeping in view the requirements and expectations of the people of the border area. It is suggested that political interference should be eliminated and the comprehensive plan for border area be prepared at least 10 years in advance for the creation of suitable and adequate infrastructures for the overall development of the border area.

References

Anonymous. 2010. *Annual Plan*, Government of Punjab, Chandigarh.
www.pbplanning.gov.in



Deals in ALL IT Services

- SERVERS: IBM/HP
- Computers: HP, Lenovo and ACER.
Laptop: HP, Lenovo and Toshiba.
- Networking: Wi-Fi, Routers, Cisco.
- Switches, Digilink Cabels, ServerRack
UPS, Printers and Plotters.

Contact:

Harpal Singh

Director

iPrime Services Private Limited

Mobile: +91-9815196241

iPrime Services Private Limited

188-L, 1st Floor Model Town, Ludhiana-141001, Phone: 0161-3050401 to 405, Fax: 0161-2440506

Email: iprimeservices@gmail.com and iprimesales@gmail.com

Guidelines for Submission of Papers/Abstracts

1. The research articles, review articles, research notes and communications in basic and applied research in economics and development are published in ***Indian Journal of Economics and Development***.
2. The journal is managed by the eminent economists under the domain of Indian Institute of Industrial Economics and Development Society and published quarterly.
3. The authors submitting papers to *Indian Journal of Economics and Development* should be members of this Society.
4. Two copies of manuscript typed in double space should be sent to the Editor, *Indian Journal of Economics and Development*, Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141004 and a soft copy to editorjed@yahoo.com simultaneously. All articles must include an abstract of about 100 words.
5. The length of papers should not be more than 20 typed pages of A4 size in Times New Roman font of size 12 including tables, diagrams and appendices.
6. Name(s) and affiliation(s) of the author(s) with email addresses should be provided on a separate page along with the title of the article.
7. Only essential mathematical notations may be used. All statistical formulae should be neatly typed. Footnotes should be numbered consecutively in plain *Arabic* superscripts.
8. **References:** Only cited works should be included in reference list. The reference list should be alphabetized and not numbered. Authors should uniformly follow the reference citation strictly in accordance to examples given under:
 - i. **Research Paper:** Sandhu, N.S. and Chhina, S.S. 1994. Marketing of wheat in India. *Indian Journal of Agricultural Development*. **20** (6): 66-78.
 - ii. **Book:** Samuelson, P. and Nordhaus, W. 2010. *Economics*. Tata McGraw Hill Education Private Limited, New Delhi
 - iii. **Chapter in a Book or Paper in published proceedings:** Sharma, J.L. and S.S.Chahal. 2009. Sustainability of agriculture development in Punjab. In: Jain, P.K., B.S.Hansra, K.S.Chakraborty and J.M.Kurup (ed.) *Food Security and Sustainable Agriculture*. U-Day Publishers and Advertisers, New Delhi: 278-290.
 - iv. **Paper in a Conference/Symposium:** Kaur, G., Chahal, S.S. and N.P.Singh. 2010. Adoption gaps in paddy cultivation in Punjab-cost involved and returns thereof. *In Proc. 13th Punjab Science Congress* organized by Punjab University, Chandigarh and Punjab Academy of Sciences, Patiala, February 7-9: 24.
 - v. **Thesis:** Balaji, M.N. (2004) *Marketing system of potato in Punjab vis-à-vis Karnataka*. M.Sc. Thesis, submitted to Punjab Agricultural University, Ludhiana.
9. **Units:** Use SI units; a few examples are given below: Hectare (ha), Milligram (mg), Rupees (₹), Million hectares (Mha), Litre (L), Tonne (t), Millilitre (mL), Million tonnes (Mt), Gram (g), Meter (m), Kilogram (kg) and Centimeter (cm). Please note that no full stop is used after the abbreviation of units.
10. All articles will be referred in anonymity. The authors should comply with the comments of the referee within 20 days time, beyond which the papers will be removed from the files of the Society.
11. Papers submitted for publication should be exclusively written for this journal and should not have been published or sent for publication elsewhere.
12. **General:** The Editorial Board reserves the right to remove the material considered irrelevant. It assumes no responsibility for the views and statements expressed by the authors in their articles.

Indian Institute of Industrial Economics and Development Society

The objectives of the Society

1. To promote awareness on the issues relating to economic development.
2. To promote better social and ethical values to promote development.
3. To promote economic prosperity and serve as a tool to create the consciousness for development.
4. To conduct research and publish reports on economic issues.
5. To organize seminars, symposia, workshops to discuss the economic problems.
6. To offer consultancy, liaison and services as a facilitator.



Indian Institute of Industrial Economics and Development Society
72-Sector 4, Ranjit Avenue, Amritsar-143001
Email: editorijed@yahoo.com