INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

The Determinants and Extent of Crop Diversification among Farmers with Small- Sized Land Holdings

Khalid, M. A.
Student, Department of Geography, Lovely Professional University, Punjab, India
A. Usman
Student, Department of Geography, Lovely Professional University, Punjab, India
A. Singh
Assistant Professor, Lovely Professional University, Punjab, India

Abstract:
This research was conducted in Jalandhar district of Punjab with aim of assessing the determinants and extent of crop diversification among farmers with small - sized land holdings. Multi-stage sampling technique was used in conducting the research. Out of the ten blocks of the district, seven blocks were randomly selected. In each of the seven selected block, a single village was further selected for sampling. Seventy questionnaires were distributed to the farmers in order to assess the factors hindering them from going for diversification. The result shows that 86.7 percent of the farmers grows rice and wheat while 3.3 percent grows rice, wheat and sugarcane. 6.7 percent grows rice, wheat and potato. The remaining 3.3 percent of the farmers grows other crops. Similarly, 55 percent of the farmers attributed the reasons of mono-cultural farming to profitability of rice and wheat. While 13.3 percent of the farmers attributed it to issue of food security. While 5 percent of the farmers attributed it to absence of any alternative crops which they can grow in place of rice and wheat. They said this absence is the cause root for their sticking to growing of rice and wheat every season. 23.3 percent of the farmers believed that the cause of mono-cultural farming is declining soil fertility, lack of assurance of income (MSP), yield and vulnerability of other crops to insect and pest attacks. For they believed that rice and wheat are more resistant to weather changes than other crops. While 3.3 percent of the farmers have adopted mono-cultural farming system due to uncertainty of monsoonal rains, perishability of the crops, poor soil condition and lack of income security in form of Minimum Support Price (MSP). It was recommended that authorities should extend the minimum support price to a wider range of other crops which farmers are willing to cultivate. For they will remove the fear of uncertainty of income at the end of the season and this will induce farmers to go for diversification. Likewise, they should make available the seeds of improved varieties of rice likes Basmati which needs less fertilizer and less rainfall and which is thus environmentally friendly.

Keywords: *Crop Diversification, Minimum Support Price (MSP)*

1. Introduction

Punjab state is the food basket of India. It occupies just 1.5 percent of the geographical area of the country. It has only 3 percent of agricultural land area (Statistical Abstract of Punjab,2011). It accounted for about 19 percent of wheat and 10 percent of rice production. It contributed to almost 50-60 percent of food grains to the federal pool of food grains (Sidhu and Johal, 2002 and Toor et al…, 2007). About 75 percent of its population are directly dependent on agriculture. Wheat and Rice are the two dominant crops cultivated in Punjab.

Wheat and rice are the two most profitable crops with least price risk. Minimum Support Price is in favour of these two crops. As a result, farmers shifted larger areas of their farmlands in favour of these two crops which resulted in mono culture of wheat in winter and rice in summer. Serious decline in crop diversity has been observed. For example, the net sown areas under wheat is 67.10 percent in 1980-1981 and 82.88 percent in 2004-5 growing season. Total number of crops grown declined from 21 in 1960-61 cropping season to 10 crops in 1980-81 cropping season and to 9 crops in 1990-91 season and stagnated thereafter. The percentage of areas under the crops other than wheat also declined from 62.74 percent in 1960-61 growing season to 22.40 percent in 1990-91 and then the decline continued reaching 17.12 percent in 2004-5 season (Toor et al.,2007). In summer season, rice emerged as the single main crop. The proportion of area under rice was 6.05 percent in 1960-61 cropping season and rises up to 47.77 percent in 1990-91 season. It further increases to 63.02 percent in 2004-5 season. Cotton is the second major crop. Areas under crops other than rice was 82.06 percent in

1960-61 and it reduces to 35.61 percent in 1990-91 season and later to 24.86 percent in 2004-5 season. The number of crops grown declined from 20 to 9 in that growing season (Toor et al.,2007).

As a result of continuous cultivation of rice and wheat, it gives the farming system a monoculture which is causing many problems to the ecosystem which includes problems like decline in soil fertility, decline in water- table depth, decline in crop yield and so, on. Rice and wheat now nearly accounted for three-fourth of the total crop area of the state. The growth rate of these crops have been increasing up to 1990s when it started rising at a much slower rate. During late 1990s the yield of both wheat and rice stagnated. The main problem of this stagnation in agricultural growth rate is its effects on Punjab agricultural capacity to absorb labour overtime with marginal labour more affected. Attempt at diversifying the farming practice from wheat -rice dominated cropping pattern to diversification will need changes in the composition and structure of capital assets. Falling water-table is a serious problem facing Punjab agriculture and its related consequences.

Out of 138 development blocks existing in the state, ninety development blocks have been classified or declared as 'Black', meaning that the water table in these blocks has gone down to a dangerously low level and withdrawal is higher than recharge (Dhillon and Sidhu, 1997). Shallow tube wells are not able to draw water for irrigation and this compelled farmer to resort to deepening their tube well bores and or at a lower place by placing electronic motor like a pit. This incurred additional cost of farming. It is estimated that Punjabi farmers are spending near about two million on deepening their tube wells yearly (Kalra and Singh, 2002). Wealthy farmers have now resorted to using submersible tube wells. The cost of submersible tube wells is depending upon the depth of the water table and the size of the bore and amounting to something between Rs 70, 000 to Rs 150, 000. And once this submersible pump is installed in an area it creates problems to the neighboring farmers because their shallow tube wells' capacity to withdraw water will be hampered. Shifting over to submersible pumps in the long-run leads to many socio-economic consequences. 26.50% of farmers in Punjab have a holding of less than one hectare each. And 18.26 % of farmers have between 1 and 2 hectares. Almost about 45 % of the farmers are classified as marginal farmers or small farmers, with a farm holding between two hectares. These small and marginal farmers cannot afford to install submersible pumps on their farms. And with well-to-do farmers shifting over to submersible pumps because of continuous decline of water table, small and marginal farmers will be automatically disfranchised from their right of using underground water. They will ultimately be sent out of the field. Their livelihood will be affected by losing irrigation source and it also affect land values and may even lead to their alienation from the land. For the will either have to sell their farm land or stop farming. This is a serious threat to marginal farmers and is also accelerating social unrest in rural Punjab.

Crop diversification is an effective approach to utilize limited land and water resources. It provides opportunities for comparatively high returns from crops by decreasing price and yield risk created by any climatic variability and price volatility of agricultural production. It also helps to use the resources like water, land and other resources effectively and judiciously and that too in an environment friendly manner. Diversification is a form of agricultural development that enhances growth and sustainable development more especially in rural sector that depends mostly on agriculture (Bhargouti et al.,2000). It is a change of input and output decision in response to changes of market forces of demand and supply in order to maximize profits. It involves adjustments of crops to micro-environments of soil and land, labour demand, machinery, enhancing cash flow, reducing production and marketing costs in order to achieve sustainable agricultural productivity (Ali and Farouq 2003 and Bharghouti et al.,2004)

At farm level, crop diversification deals with modifications of the farming system in such a way that farm practices and products are aligned with environmental, social and economic factors and finally with challenges and opportunities that avail. Reaping the benefits of farm level diversification depends solely on the level of within-farm heterogeneity in various factors such as soil and land resources, biological and economic factors and effects of insects and dieses and extent of sustainability. At the community level, crop diversification entails an establishment of a sound and vibrant system that will yield a best option in terms of resources availability and quality (Bhargouti et al., 2004). It is viewed as a strategy for reducing the reported problems of monoculture. It is a good approach which is utilizes scarce land and valuable water resources and makes agricultural productivity sustainable and eco-friendly (Joshi et al.., 2007; Kumari et al., 2010; Singh,2001 and Islam and Hossain,2013). It is believed to be a universally accepted means of rural and agricultural development. It generates high returns from crops by reducing yield and price risk which is caused by climatic variability and market shocks. It also leads to high labour employability and optimization of the use of land and other resources (Ashfaq et al., 2008, Mehta, 2009, Mukherjee, 2012 and Islam and Hossain, 2013). Diversification of crop creates an opportunity for employment and higher income generation through better uses of resources

Agricultural diversification is divided into two and they are horizontal and vertical diversifications. Horizontal agricultural diversification involves an addition of new agricultural activity into an existing farming practice which may include cultivation of new crops, livestock or aquaculture. It also includes agro-tourism, agro-processing and retail trade. Off farming activities can be considered as a form of diversification. Vertical diversification on the other hand entails adding value to farm produce produced either through processing or packaging, marketing or branding (Singh et al…, 2009).

1.1. Diversification as Tool for Food, Nutritional and Economic Security

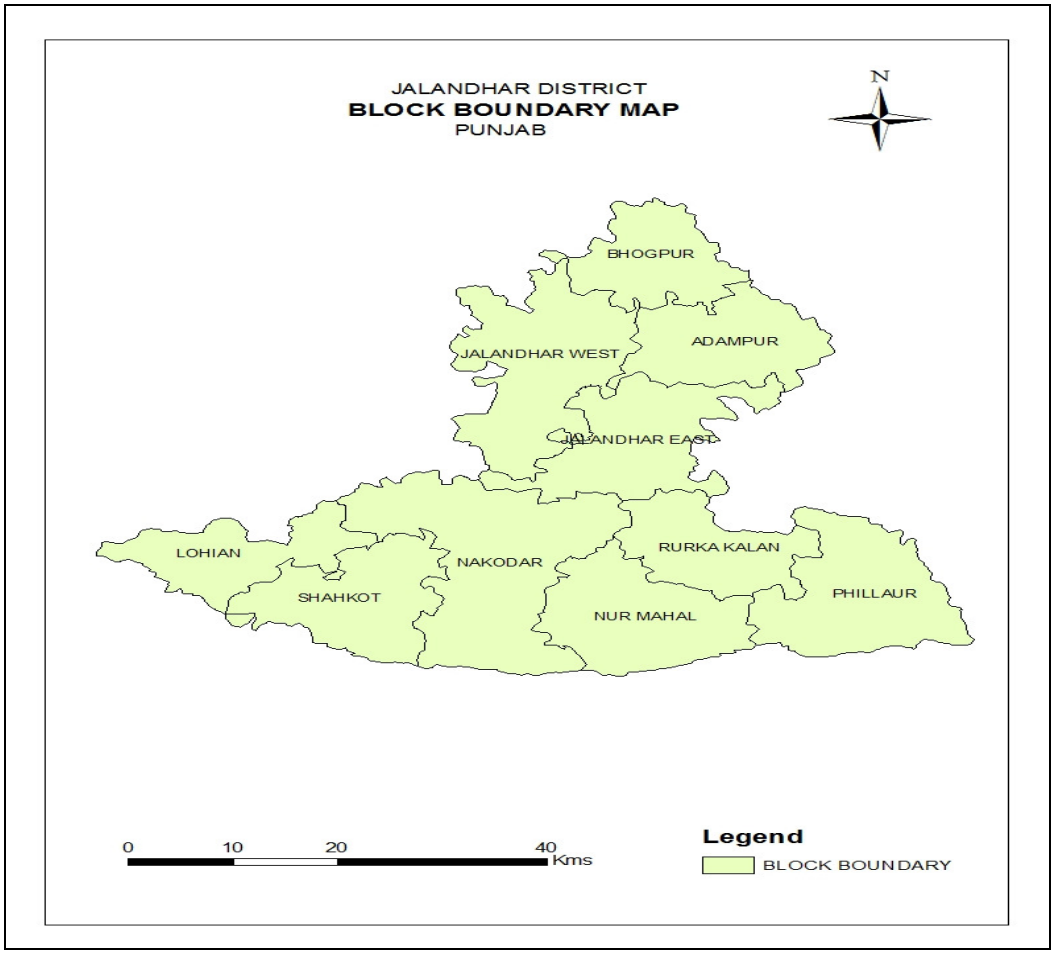
Crop diversification is believed to be an important weapon for food and nutrition security, income generation and its increases, poverty alleviation and employment generation among small, medium and marginal farmers. It also helps in making of a sustainable use of land, water and other resources. Diversification of agricultural productivity toward more competitive and high-valued crops is seen as a vital strategy for enhancing farmers' income, generation of employment, poverty eradication and soil and water resources conservation (Kumar et al ,2012). The demand for high-valued crops is increasing rapidly and likewise in international markets (Kumar et al, 2003 and Kumar et al, 2015). Diversification of crops enhances household's income, sustain their nutritional security

and makes them more resilient to external economic shocks and threats of climate change. It also leads to economic diversification, industrial booming and overall growth of the economy (Kankwamba et…, 2012). Agricultural diversification is a process of allocating productive resources to a wider ranges of economic activities. (Singh et a.., 2009 and Kankwamba et., 2012).
Diversification is a development tool as it affects both micro and macro- economic activities of a country. Countries that failed to diversify their agricultural production are bound to face challenges relating to risk and vulnerability (Kankwamba et al.., 2012). Over reliance on few number of crops meant that the country is making itself more vulnerable to weather shocks (Pauw et al.., 2010). Similarly, decline in the prices of these crops will have a negative impact on the country's GDP. Their economy will suffer more from the aftermath of the price shocks of the few crops cultivated in that economy. Cultivation of high-valued crops is labour intensive and this generates employment to teeming workers. Production of food crops with high nutritional values increases nutritional status of the farmers. But if it entails diversification from food crops to cash crops this may threaten nutritional and food security. Diversification has to deals with strategies that have to move forward and device simple abilities among producers in order to adjust to market opportunities and rational policies

So, it can be said from the above discussion that the diversification of crop is a new sustainable agricultural measure proposed in Punjab. It is the ultimate goal of the state with a view to overcome dependency on rice and wheat and to minimize risk of its growing market failures, unemployment and ecological and other environmental problems. Therefore, comprehensive study of this nature need to be conducted. As such this study attempted to analyze the determinants and the extent of crop diversification in Jalandhar district of Punjab. It focuses more on farmers with small sized farm holdings whom constituted the larger proportion of farmers in the district.

2. Materials and Methods

2.1. Study Area
Jalandhar is the center-most district of Punjab state. It has a total area of 2,662 sq. km. It is located between latitudes $30^0$59N and $31^0$37N and longitudes $75^0$04E and $75^0$57E. Administratively, the district is divided into ten developmental blocks which includes Adampur, Bhogpur, Jalandhar East, Jalandhar West, Phillaur, Rurka Kalan, Nurmahal, Nakodar, Shahkot and Lohian (Central Ground Water Board, 2007).



.*Figure 1*

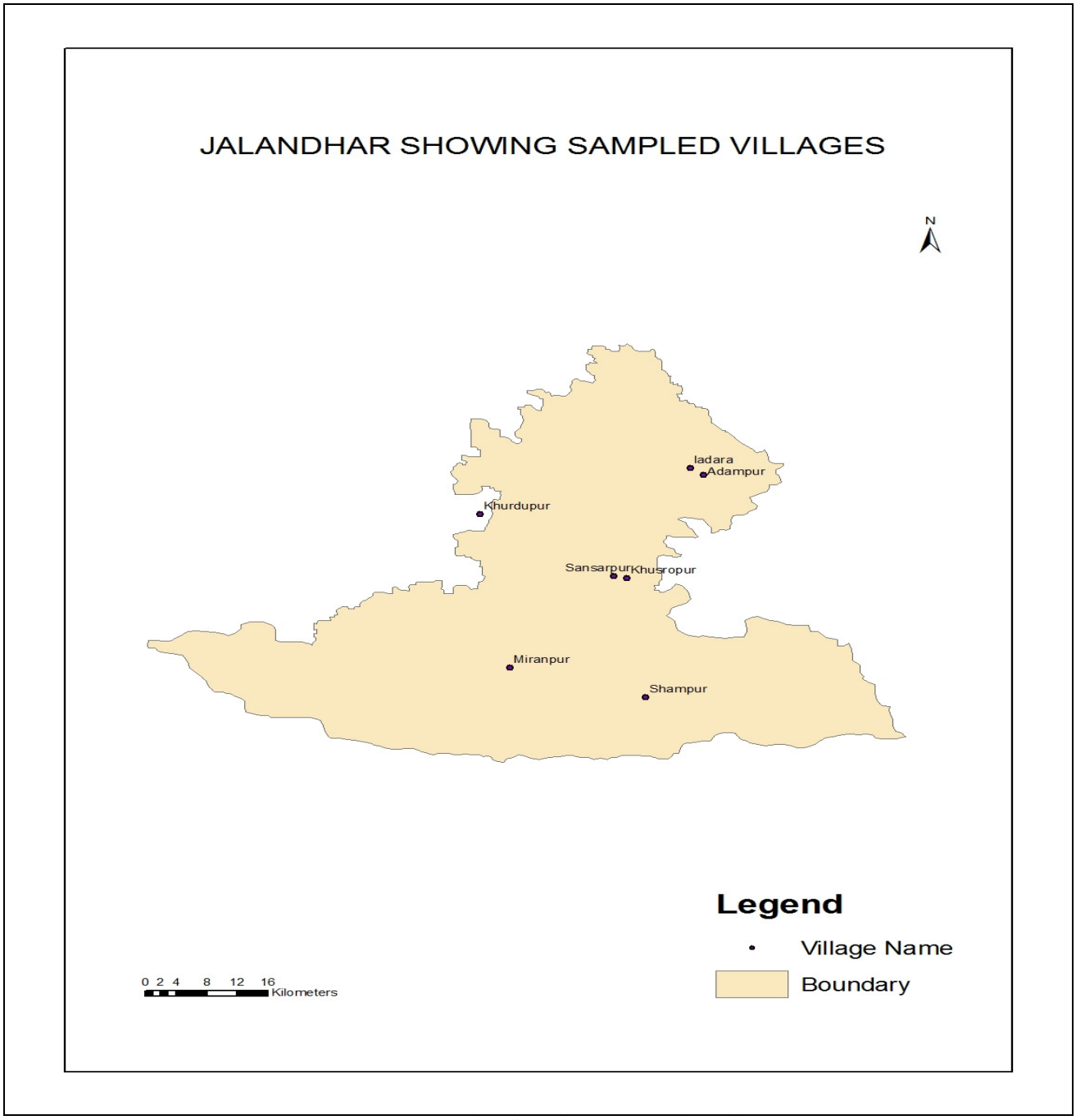


Figure 2: Map of Jalandhar Showing Sampled Villages

2.2. Sample Collection

Multi-stage sampling techniques will be adopted in this research. Jalandhar district of Punjab was selected as a study area. Jalandhar has ten administrative blocks. From these ten blocks, sevenblocks were selected randomly as a sampling points. These are Jalandhar West, Jalandhar East, Adampur, Hoshiarpur, Nurmahal, Phillaur and Nakodar. And in each of the selected blocks, these villages were selected as sampling points. They are viz: Khosrupur, Sansarpur, Khurdupur, Ladara, Shampur, Khaira and Miranpur villages which were selected. Then purposive sampling technique was adopted for picking out the respondents who are the farmers with small scale farm holdings in each of the selected village. Seventy questionnaire was distributed to the identified respondents but only 60 persons responded. The remaining ten questionnaires were not responded.

2.3. Statistical analysis

The study used both simple descriptive and inferential statistics like percentages and means as well as graphical representation. Similarly, correlation between quantity of yield and number of labour and quantity of yield and quantity of fertilizer per hectare was done in SPSS software where we check for whether there is significant correlation between these variables.

3. Results and Discussion

This chapter presented and discussed the results obtained from the analysis of result obtained from questionnaire survey conducted in the study area. Demographic and socioeconomic characteristics of the respondents, reasons for mono-cultural farming, effects of mono-cultural farming on the environment , determinants influencing farmers' decision ,comparison of the mean, minimum and maximum quantity of yield, fertilizer and number of labour used per hectare with statistical abstracts of Punjab , Comparison of the mean yield derived from the data, mean quantity of fertilizer applied per acre and mean number of labour used per acre was done with the mean crop yield, mean quantity of fertilizer and mean number of labour sourced from statistical abstract of Punjab and correlation between quantity of yield and quantity of fertilizer and quantity of fertilizer and number of labour used per acre were done in this study.

3.1. Demographic and Socio-Economic Characteristics of the Farmers with Marginal and Small-Scale Farm Holdings.

Age in Years	Frequency	Percent	Valid Percent	Cumulative Percent
40-50	39	65.0	65.0	65.0
50-60	14	23.3	23.3	88.3
60-70	4	6.7	6.7	95.0
More than 70 yrs.	3	5.0	5.0	100.0
Total	60	100.0	100.0	

Table 1: Age of Respondents
Source: Field Survey, October, 2015

From table 1.0, it shows that sixty-five percent of the respondents are between the ages of 40-50, twenty-three percent of the respondents are within the age bracket of 50-60. While 6.7 % are between the ages of 60-70. The remaining 5% of the respondents are having age of more than 70 years. In a nut shell, it shows that there is huge concentration of farmers in the age bracket of 40-50 and 50-60 respectively which accounted for almost 88 % of the farmers. This shows that there is great potential for progressive change in agricultural scenario

Crops Cultivated	Frequency	Percent	Valid Percent	Cumulative Percent
Rice and Wheat	52	86.7	86.7	86.7
Rice, Wheat and Sugarcane	2	3.3	3.3	90.0
Rice, Wheat, Potato	4	6.7	6.7	96.7
Others	2	3.3	3.3	100.0
Total	60	100.0	100.0	

Table 2: Cultivated Crops
Source: Field Work,2015

From table 2.0 it shows that 86.7 % of the farmers grows rice and wheat while 3.3 % grows rice, wheat and sugarcane. 6.7 % grows rice, wheat and potato others grows 3.3 % of other crops other than the one mentioned above.

Years of Cultivation	Frequency	Percent	Valid Percent	Cumulative Percent
5 yrs.	1	1.7	1.7	1.7
10 yrs.	11	18.3	18.3	20.0
15 yrs.	15	25.0	25.0	45.0
More than 15 yrs.	33	55.0	55.0	100.0
Total	60	100.0	100.0	

Table 3: Duration of Cultivation
Source: Field Work,2015

From table 3.0 it is evident that 1.7 % percent of the farmers have being cultivating for five years. 18.3 % of the farmers have being cultivating for 10 years. While 25 % of the farmers were in farming business for 15 years. Fifty-five percent of the farmers were in farming activities for more than 15 years.

Reasons for Mono-Cultural Farming in Jalandhar District Below is the analysis of the reason why farmers are sticking to mono-cultural farming system in the study area. The reasons are assessed from the farmers through questionnaire survey conducted to farmers in the study area.

Reason	Frequency	Percent	Valid Percent	Cumulative Percent
Profitability	33	55.0	55.0	55.0
Food Security	8	13.3	13.3	68.3
No alternative	3	5.0	5.0	73.3
Others	14	23.3	23.3	96.7
Climatic condition	2	3.3	3.3	100.0
Total	60	100.0	100.0	

Table 4: Reasons of mono cultural farming
Source Field Work,2015

From table 4.0 it shows that 55 % of the farmers attributed the reasons of mono-cultural farming to profitability of rice and wheat. While 13.3 % of the farmers attributed the reasons for mono-cultural farming to Food security. Because they believed these crops (rice and wheat) contributed larger share to national pool. Five percent of the farmers attributed the reason for mono-cultural farming to absence of any alternative crops which they can grow in place of rice and wheat. They said this absence is the cause root for their sticking to growing of rice and wheat every season. 23.3 of the farmers attributed the cause of mono-cultural farming to other reasons like soil fertility, lack of assurance of income, yield and vulnerability of other crops to insect and pest attacks. For they believed that rice and wheat are more resistant to weather changes than other crops. So that is why they opted out to continuous growing of rice and wheat. Finally, 3.3 % of the farmers attributed the continuous mono-cultural farming system to uncertainty of climatic conditions.

3.2. Effects of Mono- Cultural Farming System on the Environment

Effect of mono-cropping	Frequency	Percent	Valid Percent	Cumulative Percent
Less affecting	20	33.3	33.3	33.3
Seriously affecting	22	36.7	36.7	70.0
Very much affecting	11	18.3	18.3	88.3
Seriously affecting	7	11.7	11.7	100.0
Total	60	100.0	100.0	

Table 5: Effects on mono-cultural farming
Source: Field Work, 2015.

From table 5.0 it is being found out that 33.3 % of the farmers believed that mono-cultural farming of continuous cultivation of rice and wheat in Jalandhar district is less affecting the environment despite the obvious decline of water table throughout Punjab and more especially Jalandhar district which is termed black in all of its blocks. So there is need for massive awareness campaign from the side of government and other Non-Governmental organizations about this issue of environmental impact of continuous cultivation of rice and wheat, more especially rice which is climatically not a crop of this region. It is a crop of 100-meter isohyet. 36.7 % of the respondents said that it is seriously affecting. 18.3 % said that it is very much affecting the environment.11.7 % of the respondent believed that it is seriously affecting the environment. Ploughing and leveling or tilling of the land which is done continuously by farmers before planting should be done scientifically in order not to damage the structure of the soil. Similarly, farmers should be sensitized on water conservation techniques in order to conserve the depleting water resource in the study area.

3.3. Determinants Influencing Farmers' Decision as Regards the Idea and Practice of Crop Diversification
Below is the analysis of factors (determinants) influencing farmers' decision as regard the idea of crop diversification in the study area. These parameters are assessed from the farmers through the questionnaire survey conducted to them.

Failure to adopt diversification	Frequency	Percent	Valid Percent	Cumulative Percent
Marketability	5	8.3	8.3	8.3
Food Security	16	26.7	26.7	35.0
Less labour	11	18.3	18.3	53.3
Minimum support price	17	28.3	28.3	81.7
Others	11	18.3	18.3	100.0
Total	60	100.0	100.0	

Table 6: Why diversification of crop is not adopted
Source: Field Work, 2015

From table 6.0 it is clearly shown that 8.3 % of the farmers believed that marketability of these two crops (Rice and Wheat) is the reason hindering farmers from going for diversification. While 26.7% agreed that food security is the main reason preventing farmers from going for diversification. For these crops contributed large share to central pool. Another 18.3 % of the respondents believed that

less labour and time required in the production of rice and wheat is the main reason why farmers are not going for crop diversification. 28.3 % attributed the failure of crop diversification to security of income which is given to the farmers in the form of minimum support price. 18.3 % attributed the failure to go for diversification to uncertainty of monsoon, perish ability of the crops, soil condition and lack of income security in form of Minimum Support Price. They said, if other crops should also be given the Minimum Support Price they could go for diversification. So, it is good for the authorities to extend the minimum support price to a wider range of other crops which farmers are willing to cultivate if this price incentive is given to them. For they will rest assured about their income at the end of the season.

3.4. Assessment of the Farmers' Knowledge of the Impact of Mono-Cultural Farming System on the Environment

	Effect of mono-cropping	Frequency	Percent	Valid Percent	Cumulative Percent
	Less affecting	20	33.3	33.3	33.3
	Seriously affecting	22	36.7	36.7	70.0
	Very much affecting	11	18.3	18.3	88.3
	Seriously affecting	7	11.7	11.7	100.0
	Total	60	100.0	100.0	

Table 7: Effects on mono-cultural farming
Source: Field Work, 2015

From table 7.0 it is found out that 33.3 % of the farmers believed that mono-cultural farming of continuous cultivation of rice and wheat in Jalandhar district is less affecting the environment despite the obvious decline of water table throughout Punjab and more especially Jalandhar district which is termed black in all of its blocks. So there is need for massive awareness campaign from the side of government and other Non-Governmental organizations about this issue of environmental impact of continuous cultivation of rice and wheat, more especially rice which is climatically not a crop of this region. It is a crop of 100-meter isohyet. 36.7 % of the respondents said that it is seriously affecting. 18.3 % said that it is very much affecting the environment.11.7 % of the respondent believed that it is seriously affecting the environment.

3.5. Quantity of Farm Yield and Fertilizer Used by the Farmers in the Study Area in Kilogram per Acre

Quantity of farm yield in Kg	Frequency	Percent	Valid Percent	Cumulative Percent
200	3	5.0	5.0	5.0
500	1	1.7	1.7	6.7
800	2	3.3	3.3	10.0
1000	1	1.7	1.7	11.7
1500	17	28.3	28.3	40.0
1900	1	1.7	1.7	41.7
2000	4	6.7	6.7	48.3
2500	6	10.0	10.0	58.3
2600	11	18.3	18.3	76.7
2700	6	10.0	10.0	86.7
2800	4	6.7	6.7	93.3
2900	2	3.3	3.3	96.7
3000	1	1.7	1.7	98.3
3500	1	1.7	1.7	100.0
Total	60	100.0	100.0	

Table 8: Quantity of farm yield (In Kilogram) per acre

From table 8.0 it is clear that 5.0 % of the farmers are having farm yield of 200 kg per acre. 1.7 % of the respondents are having 500 kg per acre. 3.3 % of the farmers are having farm yield of 800 kg. While 1.7 % of the farmers interviewed are having the yield of 1000 kg per acre. 28.3 % of the farmers are having the yield of 1500 kg.1.7 % of the respondents are having the yield of 1900 kg per acre. 6.7 % of the farmers are having the yield of 2000 kg per acre. Ten percent are having 2500 kg per acre. 18.3 % are having 2600 kg per acre. Another ten percent are having 2700 kg per acre. 6.7 % are having 2800 kg per acre. 3.3 % are having 2900 kg per acre. 1.7 % are having 3000 kg per acre. Finally, another 1.7 % are having yield of 3500 kg per acre. The mean quantity of yield derived from this research is 1673.529 kg per acre which is less than the average yield of Wheat is 4693kg per hectare(statistical abstract of Punjab) while that of Rice is 3741 kg per hectare (Statistical abstract of Punjab).

Quantity of fertilizer used		Frequency	Percent	Valid Percent	Cumulative Percent
	150	37	61.7	61.7	61.7
	200	11	18.3	18.3	80.0
	250	8	13.3	13.3	93.3
	300	4	6.7	6.7	100.0
	Total	60	100.0	100.0	

Table 9: Quantity of fertilizer used (In Kilogram) per acre
Source: Field Work, 2015

From table 9.0 it is evident that 61.7 % of the respondents are applying fertilizer amounting to 150 kg per acre. 18.3 % of the farmers interviewed are applying 200 kg of fertilizer on one acre of land. 13.3 % of the respondents are applying 200 kg of fertilizer per acre of land. While 6.7 % of the farmers are applying 300 kg of fertilizer on their one acre of land.

3.6. Comparison of the Mean, Minimum and Maximum Quantity of Yield, Fertilizer and Number of Labour Used Per Hectare with Statistical Abstracts of Punjab

The mean quantity of yield computed from the data sourced from the field work is 1673 kg per acre which is 4182.5 per hectare which is far lower than the average of Punjab which is 171,000 kg. The minimum and maximum yield values in kilogram derived from the field work is 200 kg and 3500 kg respectively per acre which is equal to 500 kg per hectare and 8750 kg per hectare respectively. Similarly, the mean quantity of fertilizer derived from the field work data is 204 kg per acre which is equal to 510 kg per hectare which is higher than the average of Punjab which is just 118 kg per hectare. While the minimum and maximum quantity of fertilizer derived from the data is 150 kg (375 kg per hectare) and 300 kg per acre (750 kg per hectare) respectively. The mean number of labour used per hectare derived from the field work data is 11.1 persons per acre. While the minimum and maximum number of labour used per acre in the study area is 2 persons and 16 persons per acre respectively.

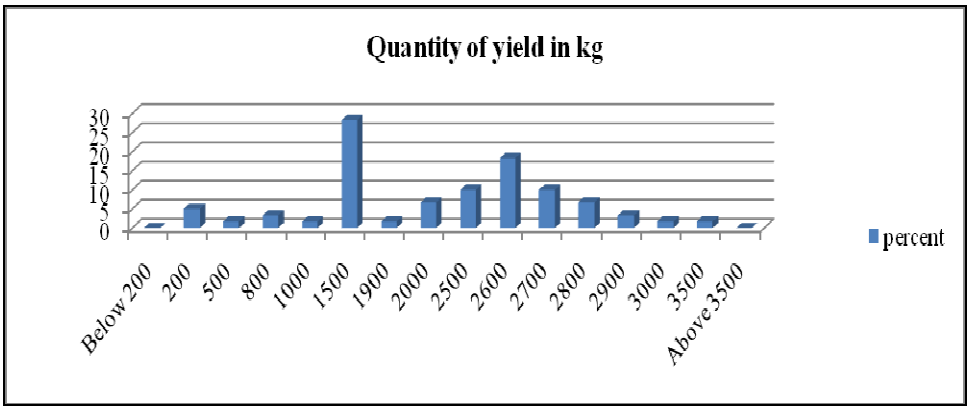


Figure 3: Quantity of yield in Kg per acre

From figure 3 it is clearly seen that farmers with 200 kg of yield accounted for almost 5 percent. 1.7 % accounted for 500 kg of crop yield per acre.3.3 % of the farmers have accounted for 800 kg. 1.7 % accounted for 1000 kg of crop yield.28.3 % of the farmers are receiving 1500 kg of crop yield per acre. Another 1.7 % of the farmers are deriving 1900 kg of crop yield per acre.6.7 % of the farmers are getting 2000 kg of crop yield per acre. Similarly, 10 % of the farmers are earning 2000 kg of crop yield per acre. 18.3 % are deriving 2600 kg per acre.10.0 % are getting 2700 kg of crop yield per acre. 6.7 % of the farmers are earning 2800 kg per acre. 3.3 % is evidently earning 2900 kg per acre. 1.7 % are earning 3000 kg and 3500 kg of crop yield respectively.

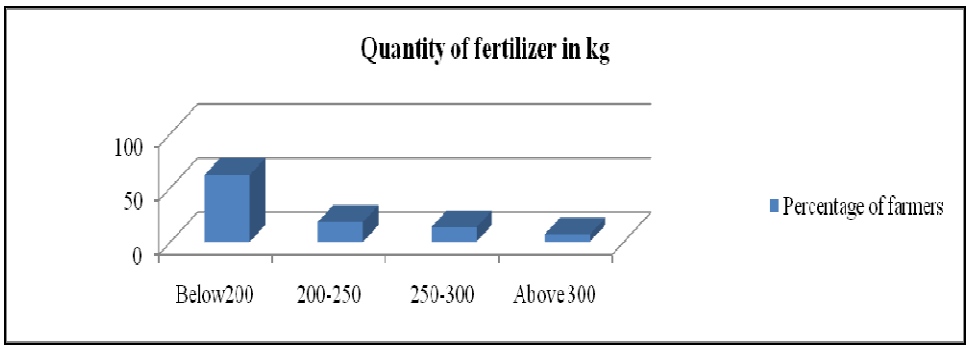


Figure 4: Quantity of fertilizer used in kg per acre

From figure 4 it is clear that 61.7 % of the farmers are applying 150 kg of fertilizer per acre which is less than the average of Jalandhar we derived from the statistical abstract of Punjab of 2011-2012 growing season which is 118 kg. 18.3 % of the farmers are applying 200 kg of fertilizer per hectare which is little higher than the average of Jalandhar which we derived from statistical abstract of Punjab in 2011-2012 growing season.13.3 % of the farmers are applying 250 kg of fertilizer. Similarly, another 6.7 % of the farmers are applying 300 kg of fertilizer. These figures are higher than the average of Jalandhar which is just 118 kg. The reason for this is because Jalandhar is farmers are applying more fertilizer than the state average which is 118 kg per hectare. Farmers may not be aware of the right quantity of fertilizer to be used in the field because they did not normally used to employ the service of soil scientist to test the nutrient requirement of their farmlands before planting. And they normally grow coarse (inferior) variety of rice which consumes large amount of fertilizer and water.

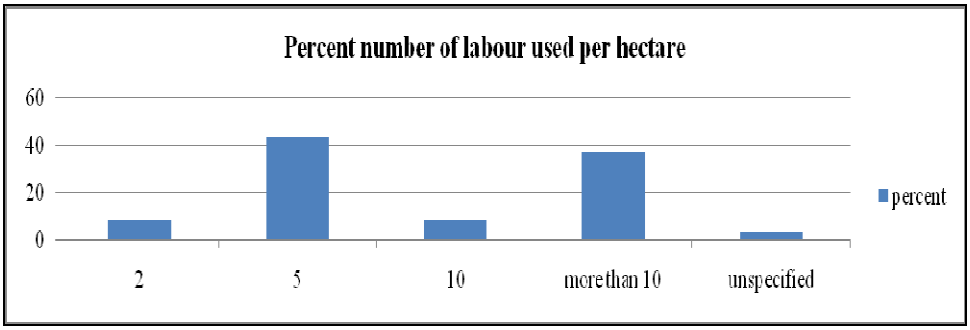


Figure 5: Percent number of labour used per hectare

From figure 5 it is shown that 8.3 percent of the farmers used two laborers per hectare of lands. 43.3 % of the farmers used 5 laborers. While 8.3 % of the farmers used 10 laborers per hectare of land. Another 36.7 % of the farmers used more than 10 labour per hectare of land. The remaining 3.3 % of the farmers did not specified the number of labour they used per hectare of land.

3.7. Correlation between Quantity of Crop Yield and Quantity of Fertilizer Used per Acre

After subjecting the data to correlation analysis in SPSS software, the calculated r = -0.290 and our tabulated r at 0.05 level of significance is 0.250. So, this shows that our calculated r value is greater than tabulated r. Hence, there is significant negative relationship between crop yield and quantity of fertilizer. This correlation value of -0.290 is low correlation but is significant. It ultimately shows that with the increase in use of quantity of fertilizer the crop yield declines. This is scientifically, the outcome of continuous cultivation of similar crops on the same piece of land which leads to diminishing of soil fertility and hence decline in crop yield. Increase in the application of fertilizer cannot increase the crop yield because the soil is already exhausted of its essential nutrients.

3.8. Correlation between Quantity of Crop Yield and Number of Labour Used per Acre

After subjecting the data to correlation analysis in SPSS software, the calculated r value is -0.574 and our tabulated r at 0.05 level of significance is 0.250. So, our calculated r is greater than tabulated r. Hence, there is significant negative relationship between crop yield and number of labour used. It indicated that with increase in the number of labour used the crop yield declines. This is indirectly related to the fertility of the soil which reaches its diminishing level due to excessive cultivation of wheat and rice for many decades.

4. References

i. Barghouti et al(2004). Agricultural Diversification for the Poor :Guidelines for Practitioners, The International Bank for Reconstruction and Development , Agriculture and Rural Development Department 1818 H Street, N.W. Washington, D.C., 20433

ii. Dao N.T.G. (2013). An analysis of technical efficiency of crop farms in the northern region of Vietnam. A thesis submitted to Canberra University

iii. De., K, U. and Chattopadhyay, M. (2010). Crop diversification by poor Peasant and role of infrastructure: Evidence from West BengalJournal of Development and Agricultural Economics Vol. 2(10), 340-350

iv. Henry K. et al (2012). Determinants and spatiotemporal dimension of crop diversification in Malawi. A project report produce under a co-financed research agreement between Irish Aid, the US agency for international development, and Malawi Strategy Support Programme (MASSP) of the international food policy research institute (IFPRI). Paper NO. 2

v. Indpreet K. (2015) . Need of Crop Diversification to achieve Sustainable Agriculture in Punjab : a brief review. Indian Journal of Economics and Development, volume 11, issue 1.

vi. Islam M. M. and Hossain M . E. (2013) Crop Diversification in Bangladesh: Constraints and Potential. Department of Economics, University of Rajshahi, Rajshahi-6205, Bangladesh.

vii. Jalota et al (2007) . Simulated Crop Yield Response to irrigation water and economic analysis :increasing irrigation water use efficiency in the Indian Punjab. Agronomy Journal, Volume 99,1073-1084

viii. Kankwamba et al.., 2012. Determinants and Spatiotemporal dimensions of crop diversification in Malawi , A Project Report produced under the co-finance research between Irish Aid , USAID and the Malawi Strategy Support Programme (MSSP) of the International Food Policy Research Institute (IFFRI) , paper No. 2 of 4 , 2012.
ix. Kanyua et al (2013). Factors influencing Diversification and intensification of Horticultural production by smallholder Tea farmers in Katanga district, Kenya. Journal of social science 5(4)103-111
x. Krishan et al.(2014).Groundwater Level Analyses of Punjab, India: A quantitative approach Octa Journal of Environmental Research, Vol. 2 (3). 221-226
xi. Kristen et al. (2003). Farmer perspectives on cropping systems diversification in northwestern Minnesota . Agriculture and Human Values 20: 371–383
xii. Kumar A.,Kumar P, and Sharma , A. N. (2012) . Crop Diversification in Eastern India: Status and determinants. Indian Journal of Agricultural Economics , Vol. 67, No. 4, 600-615
xiii. Mesfin et al (2011). Patterns, trend and Determinants of crop Diversification: Empirical Evidence from small holders in Eastern Ethiopia.
xiv. Muhammad A. et el (2014). Determinants of Crop Diversification among Small – Scale Food Crop Farmers In North Central, Nigeria.Oct. Jour. Env. Res. Vol 2 (2): 221-226
xv. Paul S, Shonchoy A . S, and Dabalen A. (2015) . Food Crop Diversification as a Risk Mitigating Strategy during Conflict: Evidence from Cote de Ivoire . Institute of Developing Economies, Jetro 3-2-1 , Wakaba Mihama-Ku , Chiba - Shi Chiba, 261-8545, Japan
xvi. REFERENCES
xvii. Sabir et al. (2006). Determinants of Small Farmers Poverty in the Central Punjab (Pakistan)J. Agri. Soc. Sci.,Vol.2, No.1. 10-11.
xviii. Sharma R. H. (2011). Crop diversification in Himachal Pradesh, patterns, determinants and challenges. Workshop on policy options and investment priorities for accelerating agricultural production and development in India. International centre, New Delhi India.
xix. Sichoongwe et al (2014). Crop diversification among small size land holders. Journal of Agricultural Science,Vol 6,No,11,
xx. Sidhu H. S.(2005) Production Conditions in Contemporary Punjab Agriculture , Journal of Punjab Studies, vol. Number 2 issue two.197-218
xxi. Singh et al (2007) . Ground Water Scenario Of Jalandhar District, Punjab. Central Ground Water Board. Ministry Of Water Resources, Government Of India ,North Western Region , Chandigarh .
xxii. Singh J, Grover D. K and Dhaliwal T. K. (2012) . State Agricultural Profile - Punjab, Agro-economic Research Center, Department of Economics and Sociology, Punjab Agricultural University, Ludhiana.
xxiii. Tobgay, S. (2005).Agriculture Diversification in Bhutan, Published by Ministry of Agriculture , Bhutan
xxiv. Toor M.S, Bhullar A.S and Kaur I. (2007). Agriculture -Led Diversification and Labour Use in Punjab: Potentials and Constraints . Indian Journal of Labour Economics, Volume 50, No. 4, 737-746
xxv. Vernooy R. (2015). Effective implementation of crop diversification strategies for Development The International Bank for Reconstruction and Development Agriculture and Rural Development Department 1818 H Street, N.W. Washington, D.C., 20433
xxvi. Vernooy R. 2015. Effective implementation of crop diversification strategies for Cambodia, Lao People's Democratic Republic and Vietnam: Insights from past experiences and ideas for new research. Biodiversity International, Rome, Italy is a member of the CGIAR Consortium – a global research partnership for a food-secure future. www.bioversityinternational.org.