

**OPINION OF FARMERS" REGARDING CROP
DIVERSIFICATION IN PUNJAB**

Thesis

**Submitted to the Punjab Agricultural University
in partial fulfilment of the requirements
for the degree of**

**MASTER OF SCIENCE
in
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(Minor Subject: Sociology)**

By

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(L-2016-A-37-M)**

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CERTIFICATE I

This is to certify that the thesis entitled “Opinion of farmers” regarding crop diversification in Punjab” submitted for the degree of **Master of Science**, in the subject of **Extension Education** (Minor subject: **Sociology**) of the Punjab Agricultural University, Ludhiana, is a bonafide research work carried out by **Mr. Jobanjit Singh (L-2016-A-37-M)** under my supervision and that no part of this thesis has been submitted for any other degree.

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This is to certify that the thesis entitled, “**Opinion of farmers**” regarding **crop diversification in Punjab**” submitted by **Jobanjit Singh (L-2016-A-37-M)** to the Punjab Agricultural University, Ludhiana, in partial fulfillment of the requirements for the degree of **Master of Science** in the subject of **Extension Education** (Minor subject: **Sociology**) has been approved by the Student’s Advisory Committee along with External Examiner after an oral examination on the same.

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ABSTRACT

The rice-wheat cropping pattern in the State of Punjab create some serious issue related to agriculture such as, decline in the water table, deterioration of soil fertility, loss of biodiversity, and microorganism, emergence of new insect pest etc. Farmers of the Punjab intensively use fertilizer and pesticides especially in case paddy crops which lead to deterioration of ground water table and soil fertility etc, in view these facts this study was conducted to know Opinion of farmers” regarding crop diversification in Punjab with objective; opinion of farmers regarding crop diversification, Socio-economic reasons for non-adoption of crop diversification, Suggestion of farmers regarding crops diversification. The study was conducted in three randomly selected districts followed by six randomly selected block (two from each district) further twelve village were randomly selected (two from each block). From each selected village 15 respondents from non-adopters category and 6 adopters, (2 from each small, medium and large category) were selected. In this way total 21 farmers were selected from each village and total 252 respondents comprised the sample of the study. Out of these 252 respondents 72 respondents were adopter and 180 respondents were non-adopter. The response of the respondent was recorded through questionnaire was used for the adopters and non-adopters to study opinion of the respondents regarding crop diversification. Findings of the study revealed that majority of respondents adopters and non-adopters belonged to middle age group, adopters were literate having qualification upto senior secondary level, while non- adopters had metric level education, majority of adopters and non- adopters belonged to nuclear family, majority of adopters had large land holding while non-adopters had small land holding, adopters prefer internet and non- adopters were prefer whatsapp, adopters and non-adopters were more participative in cooperative societies and influenced from pesticide dealers. Majority of non-adopters were preferred to grow maize-wheat crop rotation if government provides minimum support price (MSPs). Majority of non-adopters responded that lack of marketing facilities, lack of minimum support price (MSPs) in case of other crops, youth is getting away from agriculture these are the socio-economic reasons that hinder the adoption of crop diversification. Various suggestions were provided by respondents and majority said that government should provide Minimum Support Price on all crops for enhancing the adoption of crop diversification. On the basis of the major findings of the study concluded that the government should provide basic input for alternative crops and also provides assured marketing as well as minimum support price (MSPs) for all alternative to uplift the crop diversification index in estate of Punjab.

Keywords: Opinion, Crop diversification, Socio-economic, Rice wheat, Mono-cropping, Adopters, Non-adopters.

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ABBREVIATIONS

CD	- Crop diversification
MSPs	- Minimum support price
IADP	- Integrated agricultural district programme
WRCP	- Wheat-rice-cropping pattern
HYVs	- High yielding varieties
GCA	- Gross crop area
A	- Adopter
NA	- Non-adopter
ADO	- Agriculture Development Officer
HDO	- Horticulture Development Officer
NGOs	- Non government organisations
KVK	- Krishi Vigyan Kendra

CHAPTER-I

INTRODUCTION

Crop diversification is one of the most important mechanism for economic development, especially in rural areas, alternatives for farmers that can lead to enhancement in the income of farmers, improve health of soils and prevents deterioration of ground water. Traditionally, agricultural diversification is said to be a subsistence kind of farming where the farmers were cultivating more than one crops on their land and undertaking several enterprises on farm. During the recent period cultivation of high value crops is being referred as agricultural diversification.

Agricultural diversification has gained large attention from recent years in Punjab due to monoculture of crops and following of fixed crop rotations year after year. Paddy-Wheat rotation is most common in Punjab because of its assured market price. Punjab is a small state (latitude: 30° 4'N; longitude: 75° 5' E) occupying 1.53 per cent of geographical area of the country produces about 44.5 per cent of wheat and 35.8 per cent of rice production of India (India stat 2014). The state economy grew at a much faster rate (6 to 7 per cent per annum) during 1970-80 compared with 3 to 4 per cent at national level but it slowed down 3 to 4 per cent per annum after mid 1980s compared with 8 to 9 per cent at national level (world bank, 2003). Agriculture is a key element of the Punjab economy as it contributes around 40 per cent to Punjab Gross State Domestic Product (GSDP) compared to around 20 per cent at national level. Agriculture in Punjab having the highest yields of wheat and rice in India with a cropping intensity of 189.6 per cent compared with 142 per cent at India level. Punjab Agricultural development is one of the success stories of the Green Revolution strategy, and Integrated Agricultural Districts Program (IADP) launched by the Indian government in the middle 1960s to overcome from food shortages, low production and to boost up agriculture at national level. This intensive agricultural development program not only helped India achieve food self-sufficiency but also brought rich economic benefits to farmers enabling them to build up a modern agricultural infrastructure and reduce rural poverty (Sidhu *et al* 2010).

The Green Revolution helped the Punjab to move into one of the most highly mechanized agricultural states of India. However, it can be viewed as a mixed blessing for Punjab because it leads to the establishment of Wheat-Rice-Cropping-Pattern (WRCP) as a main cropping pattern in many parts of Punjab by eliminating

all the other available cropping patterns. The WRCP has been, and remains, the most preferred cropping pattern across Punjab due to its comparative economic advantages, assured marketing and stable productivity levels. As a result, WRCP continues to occupy more than 77 per cent of net cropped area of Punjab, which has further dropped the crop diversification index (Sidhu *et al* 2010).

The intensive monoculture of wheat and paddy had harmful impact on the natural resource base of the state. Excessive use of chemical fertilizers and pesticides, has added to environmental degradation, decline in water table and increase in water logging, soil salinity and pollution became the major problems in the state. The results were felt in the form of stagnation in output, declining productivity and reduction in farmers income. Diversification from existing wheat rice monoculture to alternative crops or by linking agriculture production with agri-business activities has been suggested by several economists in the wake of aggravating agrarian crisis. The Expert Committee on Diversification of Agriculture in Punjab given by Dr S.S Johal Committee (1986) recommended that at least 20 per cent area should be presently occupied by paddy and wheat which is converted to other crops such as sugarcane, rapeseed and mustard, arhar, moong, and soybean as these crops can compete to some extent with paddy and wheat. Owing to the severity of agrarian and ecological crisis in the state, another committee headed by Johal (2002) suggested that one-million-hectare area under wheat and rice needs to be shifted to other crops like oilseeds and pulses, as these crops have less water requirements and are friendly with soils.

The farmers generally carry on the wheat-paddy circle mainly because the disposal of the product is easy and the government has fixed minimum support price for both crops and it is easy for farmers to sell them in the established markets. On the other hand, no efforts have been made to develop proper market infrastructure for other crops. Farmers are not adopting vegetable cultivation mainly due to high labour requirement and absence of proper marketing. Among the different crops, which can be used for crop diversification are maize, sugarcane, pulses, and vegetables. There is an utmost need to increase awareness about the advantages of crop diversification amongst the farmers and proper steps should be taken at different levels to facilitate marketing of vegetable crops and other crops like maize, sugarcane and pulses, so that crop diversification will be adopted and help in maintain the quality of land under cultivation. In this study, it is important to depict the factors regarding the non- adoption of crop diversification by the farmers.

Keeping this in view the present study entitled, “opinion of the farmers

regarding crop diversification in Punjab” has been undertaken with the following specific objectives.

Objectives

- To study the opinion of farmers regarding crop diversification.
- To analyse socio- economic reasons for non- adoption of crop diversification.
- To seek suggestions of the farmers about adoption of crop diversification.

The findings of the study brought out the opinion of the farmers regarding crop diversification, it will help in identification of the socio-economic reasons for non-adoption of crop diversification. The study will also provide information about the various alternative crops and enterprises under taken by the farmers. In this study suggestions will be taken from the farmers, which will help to know what they think about crop diversification and what steps government should take for enhancing crop diversification in the state of Punjab.

CHAPTER-II

REVIEW OF LITERATURE

A comprehensive review of literature is crucial to any research study. The main objectives of review of literature are; to find out what work, both theoretical and empirical has been done before; assist in delineation of the problem area, provide a basis for methodological framework; suggest operational definitions of major concepts followed and provide a basis for interpretation of the findings. It provides a basis for preparing the research design of the study and conceptualization of different concepts. The researcher has tried to the best to collect most relevant review on this topic, some cross references and indirectly related references for supporting the research work. The review of literature has been classified and discussed under following sub- headings.

1.1 Studies related to socio personal characteristics of respondents

1.2 Studies related to opinion of respondents regarding crop diversification

1.3 Studies related to socio-economic reasons for non-adoption of crop diversification

1.4 Studies related to suggestions of the farmers regarding crop diversification

2.1 Socio personal characteristics of the respondents

Angadi (1999) conducted a study on knowledge, adoption and marketing pattern of pomegranate growers and revealed that majority of the respondents had not participated in various extension activities namely, discussion with extension personnel (98.76 per cent), group meetings (75.23 per cent) and training programmes (72.50 per cent). Whereas, 43.75 per cent and 38.13 per cent of the respondents participated regularly in extension activities like method demonstration and *Kisan mela*, respectively.

Gupta (1999) reported that majority of the respondents possessed radio and 86.60 per cent of the respondents possessed television as source of mass media. While, 72.00 per cent of the respondents were regular listeners of agricultural programmes and 64.67 per cent were listen other programmes. He further revealed that 74.00 per cent were aware of training programmes, 56.00 per cent were aware of field visits (32.00 per cent) and field days (28.66 per cent). One-third of respondents had participated in training programmes (36.00 per cent) and only 4.66 per cent had participated in demonstrations.

Kanavi (2000) conducted a research study on the knowledge and adoption behaviour of sugarcane growers and findings of the study revealed that, among the

different mass media sources, 82.00 per cent of the respondents listen radio and 42.66 per cent of respondents viewed television, while, 16.66 per cent of the respondents subscribed to newspapers and two per cent of respondents subscribed to agricultural magazines. Further revealed that in case of television, 13.33 per cent viewed agricultural programmes regularly, followed by news (38.66 per cent) and general programmes (15.33 per cent), respectively. He further revealed that, none of the respondents participated regularly in training and demonstrations. Nearly one third of respondents participated in *Kisan mela* (31.33 per cent). Whereas, very few of respondents participated in extension activities like study tour (4.00 per cent), group discussion (2.66 per cent) and farm visits (1.33 per cent) respectively.

Karpagam (2000) reported that, 40.83 per cent of the respondents had a land holding of 10 to 25 acres, followed by 31.66 per cent had land holdings of 5 to 10 acres and 16.67 per cent had land holding of above 25 acres. whereas, 9.17 per cent of the respondent families had land holding of 2.5 to 5 acres and 1.67 per cent of the respondent's families had a land holding up to 2.5 acres.

Kumar (2000) conducted a research for study of knowledge, adoption and economic performance of coffee growers. Findings of the study revealed that 53.00 per cent of the respondent had medium land holding, whereas 48.00 per cent of the respondent had small land holding.

Lakshmish (2000) studied impact of cashew demonstrations on knowledge, adoption and yield levels of farmers. Findings of the study revealed that half of the farmers i.e 50.00 per cent belonged to middle age group, 27.00 per cent of respondents belonged to younger age group and 23.00 per cent of the respondents belonged to old age group. He further revealed that 30.00 per cent of respondent had medium land size holding, whereas, 27.00 per cent of the farmers belong to large land holding category.

Shakuntala and Chaman (2000) conducted a research study in rural district of Karnataka state, findings of the study revealed that more than 80.00 per cent of the heads of the families and about 87.00 per cent of housewives in the village were illiterate.

Dhamodaran and Vasanth Kumar (2001) reported that majority of the respondents had high school education i.e 35.83 per cent, followed by middle school 25.00 per cent, primary 16.67 per cent and collegiate level 15.00 per cent.

Dhamodharan and Vasanthkumar (2001) reported that half (53.33 per cent) of the respondents had medium level of mass media exposure and by 40.00 per cent of the respondents with high level of mass media exposure.

Babanna (2002) conducted a research study on arecanut growers in Shimoga district, findings revealed that majority of the respondents i.e 44.20 per cent had up to 4th standard education followed by 39.20 per cent of the respondent having education level above 4th standard and only 16.60 per cent of the arecanut growers had up to 2nd standard education.

Babanna (2002) findings of the study revealed that majority of the respondents i.e 38.40 per cent belonged to old age category, 35.00 per cent of respondents belonged to middle aged and 26.60 per cent of respondents belonged to younger age group.

Vedamurthy (2002) conducted a research study of Marketing pattern preferred by the farmers in Shimoga district and reported that 38.66 per cent of the respondents studied up to high school, almost equal per cent of the arecanut growers are educated up to primary school (13.33 per cent) and college (14.66 per cent). Only 8.00 per cent of the respondents are illiterate and 6.66 per cent of the arecanut farmers are graduates.

Vedamurthy (2002) reported that 25.33 per cent of respondents belonged to old aged category, 40.00 per cent belonged to middle age category and 34.66 per cent belonged to younger age category.

Shashidhara (2003) conducted a research study on socio-economic profile of drip irrigation farmers and reported that majority of the respondents i.e 31.11 per cent had studied up to high school followed by 30.00 per cent of respondents had graduation. Whereas, middle and primary school education was possessed by 8.89 per cent and 5.56 per cent of the respondents respectively.

Venkataramalu (2003) assessed that majority 25.83 per cent of the respondents studied up to primary school followed by 22.50 per cent of the respondents were illiterates, 21.67 per cent up to high school, 15.00 per cent were had middle school level education and only 8.33 per cent of the respondent had graduation.

Venkataramalu (2003) conducted a research study on the knowledge level, adoption and marketing behaviour of chilli growers and reported that majority of the farmers participated in discussion with village extension workers (70.00 per cent), *Kisan mela* (62.50 per cent) and exhibitions on agriculture (61.67 per cent).

Kumar (2004) assessed the farmers knowledge and adoption of production and postharvest technology in tomato crop and findings revealed that 23.00 per cent of the respondents participated in agricultural exhibition followed by 20.83 per cent in demonstrations. Majority of the respondents were never attended activities like

training (66.67 per cent), educational tour (94.17 per cent) and field visits (92.05 per cent) and further reported that 40.00 per cent of the respondents had large land holding, nearly an equal per cent of the respondents belonged to medium followed by 24.16 per cent of the respondent had small land holding and only 10.00 per cent of respondents belonged to marginal land holding category.

Moulasab (2004) reported that 74.17 per cent of the respondents viewed television, 32.50 per cent of the respondents subscribe farm magazine and 6.60 per cent of the respondents were the subscribe newspapers.

Raghavendra (2004) conducted a research study on knowledge and adoption of post-harvest technologies by red gram cultivators and found that 24.66 per cent of the respondents participated regularly in agricultural exhibitions and 22.67 per cent respondent participated in demonstrations.

Raghunandan (2004) revealed that one fourth 25.26 per cent of the respondents were illiterates, 22.50 per cent studied up to primary school, 20.00 per cent up to middle school, 15.00 per cent up to high school, 11.25 per cent of respondents up to pre-university and only 5.00 per cent had graduation.

Shashidhara (2004) reported that majority of the respondents fall under middle age i.e 48.33 per cent, 31.66 per cent of the respondents belonged to younger age group and 20.00 per cent of respondent belonged to old age groups. He further revealed that, 45.83 per cent of the respondents participated in group meetings, followed by exhibition (41.66 per cent) and 18.33 per cent of the respondents participated in *Kisan mela* and also reported that majority 34.99 per cent of the respondents belonged to large land holding category followed by medium category (29.99 per cent) and semi medium category (21.68 per cent) whereas, only 13.33 per cent of the respondent belonged to small farmers category.

Suresh (2004) conducted a research study on entrepreneurial behaviour of milk producers in Chittoor district of Andhra Pradesh and found that, 64.17 per cent of respondents were exposed to mass media to a moderate extent, followed by 21.25 per cent to low extent and 14.58 per cent to high extent.

Chandramouli Pandeli (2005) revealed that 42.50 per cent of the respondents belonged to low extension participation category, followed by medium (29.16 per cent) and high (28.33 per cent) extension participation categories, respectively.

Gowda (2005) conducted a research study on cultivation and marketing pattern of selected cut flowers and revealed that 31.50 per cent of the respondents had medium land holding followed by semi medium (28.12 per cent), small (20.30 per cent) and large (14.06 per cent) respectively.

Kumar (2005) studied the knowledge and adoption of rose growing farmers in Bangalore and Belgaum districts of Karnataka and revealed that 41.67 per cent of the respondents had semi-medium land holding followed by 30.00 per cent had medium land holding, 21.67 per cent had small land holding and 6.67 per cent had marginal land holding.

Pandeli (2005) revealed that majority of the respondents belonged to medium participation category (44.17 per cent). Whereas, 29.16 and 26.67 per cent of farmers belonged to high and low participation category, respectively.

Patil (2005) assessed the knowledge, extent of participation and benefits derived by participant farmers of the watershed development programme and reported that nearly 30.00 per cent of the respondents had education up to high school, followed by middle school 28.00 per cent and primary school 27.33 per cent. Nearly 12.00 per cent of respondents were illiterates and only 4.00 per cent of respondents had graduation.

Reddy (2005) revealed that majority of the respondents i.e 80.00 per cent possessed radio and 54.00 per cent were possessed television, while, 40.61 per cent of the respondents subscribe newspaper. Further revealed that in case of radio, 22.00 per cent of respondents listened to agricultural programme regularly and in case of television, 25.34 per cent of respondent farmers viewed the agricultural programme regularly.

Thiranjangowda (2005) observed that 73.43 per cent of the cut flower growers had occasionally participated in demonstration, while 26.43 per cent of the respondents regularly participated in demonstration.

Thiranjangowda (2005) conducted a research study of knowledge and adoption level of soil and water conservation practices by farmers in north Karnataka and observed that 42.25 per cent had medium land holding followed by semi medium (28.12 per cent), small (20.31 per cent), large farmers (14.06 per cent) and marginal farmers (6.25 per cent) respectively.

Vinay Kumar (2005) conducted a study on knowledge and adoption of rose growing farmers and found that 76.67 per cent respondents viewed television regularly, followed by 65.00 per cent of respondents listen radio and only 13.33 per cent of the respondents were subscribed newspaper.

Bheemappa (2006) studied the knowledge level of Gram Panchayat members about Sampoorna Grameen Rozgar Yojana and revealed that majority of the respondents (60.83 per cent) had medium, followed by high (21.66 per cent) and low (17.50 per cent) levels of extension participation.

Reddy (2006) conducted a study of “Knowledge and adoption of integrated pest management practices among vegetable growers and reported that majority 29.17 per cent of the respondents had middle school and 25.83 per cent of respondent had primary school education, whereas high school and higher secondary school was noticed with 12.50 per cent and 11.63 per cent of respondents, respectively and only 3.33 per cent of the respondents were had graduation.

Chandrashekhar (2007) findings of the study revealed that, 43.33 per cent of the respondents had high school level of education, followed by 26.67 per cent up to middle, 13.33 per cent up to primary, 7.50 per cent of respondents were illiterate, and 0.83 per cent of the respondents fall in post graduate category.

Nagadev and Venkataramaiah (2007) conducted a research to study the characteristics of integrated pest management (IPM) of dry paddy farmers. Findings of the study revealed that 66.00 per cent of respondents were belonged to middle age category, 19.33 per cent belonged to old age category and 14.67 per cent respondents were belonged to younger age category. Further reported that 39.33 per cent of respondents fall under semi medium category, 20.00 per cent had medium land holding while 26.67 per cent had small land holding and 12.00 per cent had marginal land holding, only 2.00 per cent had large land holding. Finding of the study further revealed that the characteristics of integrated pest management (IPM) of dry paddy farmers and found that about 16.67 per cent of the respondents were illiterates, while 83.33 per cent of the respondents were literates in different groups and also reported that majority (74.00 per cent) of respondents had medium mass media utilization, followed by low (16.00 per cent) and high (10.00 per cent), respectively.

Chidananda (2008) found that majority of the farmers 35.00 per cent were educated upto high school level followed by 21.67 per cent up to middle school, 15.83 per cent up to primary school, 13.33 per cent up to college level, 10.00 per cent of the respondents were illiterate and only 4.17 per cent of the respondents were graduate .

Khule *et al* (2008) studied knowledge levels of paddy growers about low cost crop cultivation technology in Bhandara district. Results revealed that, 24.00 per cent of respondents belonged to 30 years, 38.67 per cent of respondents belonged to 36 to 50 years age and 37.33 per cent of respondents belonged to 51 and above years up to 30 years.

Khule *et al* (2008) conducted a research study on knowledge levels of paddy growers about low cost crop cultivation technology and revelled that, 20 per cent,

36 per cent, 30.67 per cent and 15.33 per cent of respondents belonged to low, low medium, high medium and high extension contact categories, respectively.

Patil (2008) studied the constraints analysis of grape exporting farmers of Maharashtra state and findings of the study revealed that majority (70.00 per cent) of the respondents were from medium extension participation category followed by low (19.00 per cent) and high extension participation categories (11.00 per cent) respectively.

Sain (2008) conducted a study on socio-economic and technological constraints in adoption of system of rice intensification (SRI) techniques in Chhattisgarh, Madhya Pradesh, Uttarakhand, Punjab, Tripura and Andhra Pradesh estates of India. Findings of the study revealed that majority 38.00 per cent of respondents were illiterates, 32.00 per cent of farmers had education up to high school level, 19.00 per cent and 11.00 per cent of farmers had education up to primary school and college level, respectively.

Sidram (2008) reported that majority (60.83 per cent) of the respondents belonged to large land holding category followed by 23.33 per cent and 15.83 per cent of the respondents belonged to medium and small land holding categories, respectively.

Hinge (2009) revealed that (38.75 per cent) had medium mass media participation. Nearly one third of them (32.50 per cent) belonged to low mass media participation category and 28.75 per cent of them belonging to high mass media participation category.

Kumar (2009) conducted a study on technological gap in recommended soybean cultivation practices and reported that, 45.33 per cent of respondents belonged to medium land holding category, followed by 22.67 per cent of the respondents belonged to semi-medium land holding category, 16.67 per cent of the respondents had small land holding and 4.66 per cent had big large holding.

Madhushekar (2009) revealed that 28.75 per cent of chilli growers had primary school education, 13.74 of respondents had high school level education, 9.38 per cent of the respondents were graduate and 1.25 per cent of respondents were post graduate.

Madhu (2010) conducted a study on technological gap in turmeric production practices and reported that, 38.60 per cent of respondents were illiterates, 28.60 per cent of respondents had primary school education followed by 10.70 per cent of the respondents had middle school education.

Cavane (2011) studied the Farmers Attitude and Adoption of Improved Maize

Varieties and Chemical Fertilizers in Mozambique” and revealed that 54.20 per cent, 31.70 per cent, 10.00 per cent, 4.20 per cent of respondents belonged to less than 40, 45 to 60, 61 to 75 and more than 76 years age groups, respectively.

Cavane (2011) reported that 14.20 per cent, 79.20 per cent and 6.70 per cent of the respondents belonged to illiterate primary school, secondary high school, respectively.

Kumar (2011) conducted a research for study of entrepreneurial qualities and adoption behaviour of banana growers in Gulbarga district of Karnataka. Results revealed that majority of the respondents i.e. 60.83 per cent were belonged to middle age category followed by 21.67 per cent and 17.50 per cent of respondents belonged to old age and young age categories, respectively. Further revealed that majority of respondents (37.50 per cent) belonged to large land holding category. Whereas, 25.83 per cent of the respondents had small land holding followed by marginal, medium, and semi-medium farmers with 9.17, 19.17, 8.33 per cent, respectively and also reported that majority of the respondents (40.83 per cent) had high school education followed by education up to PUC, illiterate, graduation, primary school and middle school with 19.17, 15.83, 13.33, 7.50 and 3.33 per cent, respectively.

Patel *et al* (2011) conducted a research for study of knowledge level of cotton growers about integrated pest management technology and concluded that majority 68.46 per cent of respondents were literates.

Patel *et al* (2011) studied the knowledge level of Cotton growers about integrated pest management technology and concluded that majority of respondents i.e. 32.92 per cent belong to middle age groups.

Patel *et al* (2011) conducted a research study on knowledge level of Cotton growers about integrated pest management technology and reported that 24.54 per cent of respondents regularly participated in extension activities.

The above studies revealed that majority of the respondent belonged to middle age categories, studied up to primary school, had medium land holding and possessed television and radio as important source of mass media.

2.2 Opinion of farmers regarding crop diversification

Renuka (1982) revealed that majority of the respondents i.e. 92 per cent had favourable and 84 per cent of the respondents had highly favourable attitude towards farm credit advanced by nationalized commercial bank.

Dhaliwal (1990) found that attitude plays a dominant role in adoption of new post-harvest technologies. Findings of the study revealed that farmers had positive

attitude on post-harvest issues of horticultural crops i.e. environmental, technological and economic aspect. Attitude of farmers can be more favourable if they are equipped with the knowledge on diversification, proper selection of appropriate technologies and financial assistance to gain more return with minimum risk.

Sakuntala and Chaman (2000) revealed that the importance of different factors, influencing the farmers' decision to bring more area under these crops varies from one development block to other because of variations in socio-economic geographic-climatic factors. Nonetheless, on a more general plane, factors like the size of landholdings, availability of irrigation facilities, availability of family labour, family size, non-farm income and education of the head of the family were important determinants of the process of crop diversification at the household level.

Sidhu *et al* (2008) reported that farmers had good perception about sustainable technologies such as crop diversification, crop rotation and application of manure but in general farmers were mostly preferred modern technologies to local ones. farmers perceived that agrochemicals as the best means to combat against insect-pests and increase rice production.

Kumar and Chattopadhyay (2010) revealed that some essential factors influencing the opinions of farmers towards organic farming system. The Organic Farmers interviewees showed a greater favourable attitude towards organic farming, whereas the Non- organic Farmers interviewees showed somewhat reluctant attitudes, mainly because of their general lack of motivation.

Kumar *et al* (2010) studied attitude of farmers towards goat and sheep rearing and revealed that 78.57 per cent of the farmers had favourable attitude, while 2.86 and 18.57 per cent were having strongly favourable and unfavourable attitudes respectively. Among the sheep rearing farmers, 54.29 and 16.43 per cent had favourable and strongly favourable attitude. Only 29.28 per cent of the respondents had unfavourable attitude towards sheep rearing.

Aheibam *et al* (2017) reported that fundamental requirement for a successful policy implementation in sustainable agriculture is based on understanding the graduate students' attitudes and knowledge. Also reported that senior students' attitudes are positive towards sustainable agriculture in general and especially towards environmental aspect. Findings of the study revealed that the importance of the ecological dimension in agricultural higher education and also showed that students' knowledge in the field of agricultural policies is low.

The above studies revealed that attitude of farmers is more favourable, if

they are equipped with knowledge related to various aspects of crops diversification, knowledge is the best key to motivate the farmers for adoption of innovation in agriculture field.

2.3 Socio- economic reasons for non-adoption of crop diversification

Bhaskaran and parveena (1982) reported that the main reasons for non-adoption of crop diversification were lack of knowledge, less practibility, non-availability of proper guidance and higher cost in using particular practice.

Dhesi (1989) revealed that area under fruit and vegetables cultivation had increased considerable the problem of marketing of these is still persisted. The establishment of fruit processing plants in the state could solve this problem.

Srivastava *et al* (1989) revealed that there were three major constraints viz: lack of adequate supply of improved seeds, recurrence of floods, also occasional draught situation and lastly insect pest and diseases attack. Majority of the farmers in all the farm categories reported occurrence of insect pest and diseases attack as major constraints. Farmers quoted that except few improved varieties no other HYV have been evolved suiting the agro-climatic and environmental condition in the area. Even the seeds of already improved varieties are quoted by large and very large farmers were not available in time and in adequate quantity. Only one third of the total respondent and majority in large and very large farmers' categories reported floods, as well as occasional drought situation as constraints.

Umesh and Bisaliah (1989) found that among bio-physical factors variety, seed treatment, time of sowing, spacing, plant nutrients, diseases and pest and irrigation constrained the higher productivity. Besides socio-economic characteristics, input non- availabilities and heir cost, crop input, credit, marketing, technical guidance and its accessibility and feasibility do seem to have equal effect on all the farm group performance. These are the important factors which acted as constraints in the adoption of new technology and input use.

Dhaliwal (1990) reported that lack of marketing facility, yield of other crops is being not sure as of wheat and paddy and lack of minimum support price for others crops to be a problem in diversification of farming. The other problems brought out by farmers were lack of resources, lack of good variety seed, lack of technology and irrigation water scarcity.

Umesh and Bisaliah (1990) found that oilseeds crops received inadequate attention in terms of improved seeds, irrigation, fertilizers, plant protection, measures etc. added to these constraints are procurement, Storage, marketing and failure of crop were major problems.

Thakur *et al* (1994) found that low price paid to the farmers, malpractices, lack of mechanical grading, packing and proper storage facilities, lack of low cost transportation facilities, lack of market information and market news, lack of price regulation and control, lack of processing units and co-operative society were the major marketing problems faced by vegetable growers.

Mishra *et al* (1995) assessed that lack of infrastructural facilities; institutional credit and illiteracy were the main marketing constraints.

Mohapatra (1999) reported that unavailability of storage, Non-availability of adequate institutional credit facilities, poor transportation facilities, lack of Minimum support price were forced to dispose their produce at the lowest possible price

Shah (1999) concluded that due to poor storage conditions majority of the onion producers sell their produce immediately after harvest, the marketing intermediaries had certainly taken advantage of this situation. This has led to unremunerative prices offer for the onion crop. Hence, the farmer is forced to sell the produce at lower prices.

Kumar *et al* (2000) conducted a research study on constraints causing serious concern to turmeric growers and reported that high fluctuations in market prices, unavailability of suitable variety, resource poor farmers, lack of cold storage and ware-housing facility were the major constraints experienced by the turmeric growers.

Ravishankar and Katteppa (2000) reported that 94.16 per cent respondents faced the problem of lack of technical guidance, more pests and more diseases, high cost of fertilizer and non- availability of fertilizers in time, were the problems faced by 90.00 per cent, 83.33, 85.00, 81.66 and 68.33 per cent of respondents, respectively.

Thyagarajan and Vasanthakumar (2000) conducted a research study on constraints to high yields in rice at farm level and revealed that lack of minimum support price was found to be the first important constraint faced by 36.33 per cent of the respondents and high cost of inputs was the second constraint expressed by 34.00 per cent of respondents.

Patil and Jadhav (2000) reported that high cost of onion seed and fertilizers was considered as major constraints for onion growers. Lack of knowledge about recommended fertilizer doses, difficulty in identifying the pests and diseases of onion, water shortage in summer, labour problem for weed control, ineffective and costly weedicides, were the production constraints of onion growers. Labour

problem during harvesting, lack of knowledge about improved storage structure, lack of knowledge about grading, open auction sale leading to less market price, low price and fluctuation in market price were the major problems faced by growers.

Kumar (2004) reported that majority of the farmers (75.83 per cent) faced the problem of technical knowledge and guidance about improved cultivation practices as well as post-harvest technology. Whereas, 65.00 per cent of the respondents faced the problem of high fluctuation in market price, followed by high transportation cost (62.53 per cent), labour shortage and high wages (55.83 per cent) and lack of irrigation facilities and power shortage (46.66 per cent).

Raghavendra (2005) studied knowledge and adoption of recommended cultivation practices of Cauliflower growers and reported that high cost of fertilizer was a problem faced by 85.00 per cent of respondents followed by problem of pest (80.00 per cent), problem of disease (78.30 per cent), limited and irregular power supply (38.30 per cent) and high cost of plant protection chemicals (38.33 per cent). While fluctuation in prices (81.60 per cent), exploitation by middlemen (71.66 per cent) and poor transportation facilities (35.60 per cent) were the major marketing problems.

Angadi (2006) found that lack of storage facility, high incidence of pest and diseases, non-availability of skilled labour for pruning, expensiveness of pruning operations, costly chemicals and fertilizers and lack of processing units were the major constraints faced by pomegranate growers.

Binkadakatti (2008) revealed that 50.00 per cent of trained respondents expressed lack of knowledge about quantity and method of use of bio-fertilizers and bio pesticides, followed by 40.00 of trained respondents expressed that lack of guidelines about seed treatment. 31.25 per cent of trained respondents expressed that that non-availability of bio-fertilizers and bio-pesticides in nearby market.

Kumar (2009) conducted a research study on technological gap in soybean cultivation and found that, high cost of inputs (88.00 per cent), shortage of labour (85.33 per cent) and lack of knowledge about disease control (77.00 per cent) were the major constraints.

Madhusekhar (2009) studied constraints in adoption of chilli technology in Nanded district of Maharashtra and reported that majority of the respondents (93.33 per cent) experienced high cost of insecticides and pesticides, followed by fluctuation of prices of chilli (86.00 per cent).

Shilpashree (2011) reported that price fluctuation (65.00 per cent), lack of timely guidance in time by extension staff (57.50 per cent), non-availability of

labour during peak period (52.50 per cent) and high cost of labour (50.00 per cent) were the major problems faced by respondents.

Naik (2012) conducted a research study on knowledge and adoption of recommended cultivation practices of onion by farmers and reported that onion growers were faced problem related to storage, marketing, transportation, exploitation by commission agents and untimely availability of market information.

Bowman and Zilberman (2013) revealed that expansion and adoption of diversified farming system is limited by a number of factors, which includes limited demand for products, supply-side constraints: such as high costs of tilling, lack of policies such as subsidies on alternatives crops and lack of implementation crop insurance scheme.

Rahima *et al* (2013) studied the detriments of crop diversification using data on three stage randomly selected household in Ethiopia and reported that factors that were affecting crop diversification were gender, education and trade experience. Findings of the study suggest that government should encourage female participants, invest on education of the farmers, provide incentives to extension workers, improve the extension system, government should strengthen agricultural research, develop technology on the basis of agro-ecology. Social organization is a powerful tool to increase the diversification capacity of the farmers, so there was a need to improve the social organization for the purpose of crop diversification.

Girish (2014) found that diversification was necessary for solving problem of rural unemployment, poverty and starvation. He also studied that problems like lack of availability of inputs, lack of training on technical aspects ,lack of technical know- how, lack of credit facilities, high initial investments, and lack of proper marketing facilities were major reasons in accelerating the process of diversification. He also reported that lack of proper irrigation facilities, lack of knowledge and information, and non-availability of timely credit. Further, in the livestock sector, mostly small and marginal farmers are not easily access to veterinary service. Diversification into fisheries sector was mostly constrained by lack of timely credit, inaccessibility to cold storages, poor road conditions and connectivity and transportation problems.

Sarkar and Das (2014) reported that Punjab, experienced a major shift from canal irrigation to tube well irrigation as it was a more reliable source of water and assuring a greater increase in yield. With groundwater as the major source of irrigation, the semi-arid state of Punjab shifted from the traditional wheat-maize cropping pattern to the water-intensive wheat-rice cropping pattern.

Sharma (2014) revealed that the growth and the diversification was a major problem, the agricultural sector is facing many problems such as low productivity, low production, poor marketing facilities. He also suggested that farmers will not adopt new crops for the replacement of paddy-wheat cropping pattern unless they are assured of marketing of their produce.

Dube (2016) revealed that the crop diversification index for the year 2009-10 in comparison to 1999-2000 exhibits a decreasing trend which is not healthier for crop diversification. The environmental constraints and natural resources are localized in few areas and technological inputs, infrastructure and facilities are very low and not equally distributed in all the areas.

Aheibam *et al* (2017) studied that the determinants of crop diversification and reported that farming experience of household head, education level, farm size, access to credit and access to irrigation are the main factors that positively and significantly affected crop diversification among the sampled farmers. However, age of household heads, non-farm/off-farm income and distance to market were observed to have a negative and significant impact on crop diversification degrees (indexes) among the sampled farmers.

Singh *et al* (2018) revealed that the diversification was found less in the region having dominant traditional system of farming. The factors such as percentage of HYVs area to GCA, average holding size and per capita income could be seen as determinants of crop diversification in eastern region. They are also suggesting that Strengthening of crop diversification depends on market and elimination of production risks through technological support, quality input supply, insurance cover and existence of modern storage -processing centres in the region. The above studies revealed that prevailing market situation, lack of market facility, lack of minimum support price (MSPs) for others crops, lack of storage infrastructure were major reasons for non-adoption of crop diversification

2.4 Suggestions of the farmers about adoption of crop diversification.

Atibudhi (1998) concluded that the exploitation of farmers by the traders can be minimized by strengthening the market committee, providing proper marketing facilities, competent staff and strict enforcement of regulated market act.

Srivastava *et al* (1998) suggested that high yielding variety to be evolved possessing the pest and disease resistance and early in maturity, crop loan facility should be timely and adequately, the price of fertilizers, insecticides and fungicides should be reduced and the technical information should be given in time to the farmers.

Mohapatra (1999) found that establishment of storage godowns at each block head quarter and in the onion producing areas is necessary to get fair prices for the produce in lean season, regulation of onion sale price should be done by government through involvement of regulated market committee by establishing procurement centres, so that exploitation by middleman can be minimized and institutional credit facilities at right time should be extended to the onion farmers on priority basis.

Murthy and Subrahmanyam (1999) reported that India exports to neighbouring countries were either decreasing or stagnated. Hence, it should aim not only to capture the new markets but also to arrest the declining trend and to increase the exports to existing traditional markets like Srilanka, Nepal and Bangladesh.

Shah (1999) stated that to create chain of scientific onion storages in different region of the country, reduce the post-harvest losses in order to meet increasing demand in the international market, marketing systems and encompassing onions also need improvement in the efficiency.

Yadav (1999) suggested that co-operatives and Government agencies to intervene in marketing of onion. There is a need to develop onion varieties with high yield, resistant to pest and diseases. Study also suggested to bring onion add to essential commodity act (1954). As when there is a shortage of onion in the market, the prices will go up and during glut the prices come down drastically. So, the Government should monitor and control the stalk at district level and procurement prices can be fixed by Government, this will help to get rid of problems in production and marketing of onion.

Stigter (2000) reported that integrated farming system approach provides insurance against climate risks and also enhances the adoption of crop diversification. Multiple enterprise agriculture consisting of crop, livestock, poultry, fish farming and trees in a single unit of land will ensure protection against projected loss due to climate change and also enhances the crop diversification.

Waman and Patil (2000) concluded that the extension functionaries had to play an important role in pursuing farmers by frequent visits and disseminating the improved onion storage technology by conducting demonstration on farmer's field, training and field trips.

Malik and Singh (2002) suggested that government should initiate the steps for expansion in irrigation facilities, availability of production technology, transport, communication, market infrastructure and processing facility for high value crops should be strengthened in the state and also advised to farmers avoid adoption of same crops rotation over the years.

Mohapatra *et al* (2009) reported that agriculture insurance in the state has a complete scope of bringing out diversification in agriculture since the farmers has to be assured of risk causing loss in production. Crops like maize, sugarcane, potato, and cotton, bear higher instability in yield as comparison to wheat and rice. The small and marginal farmers are experiencing greater variability in crop yield as compared to medium and large farms. Hence Insurance of such crops can provide a good scope for bringing out diversification in agriculture.

Kalaiselvi (2012) revealed that the crop diversification in India is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops. Crop shift also takes place due to Government policies and thrust on some crops over a given time, for example creation of the Technology Mission on Oilseeds (TMO) to give thrust on oilseeds production as a national need for the country requirement for less dependency on imports. Market infrastructure development and certain other price related supports also induce crop shift. Often low volume high-value crops like spices also aid in crop diversification. The study had made suggested that establishment of agro processing industries and infrastructure facilities, arrangement for crop protection, construction, maintenance and management of irrigation works, research prioritization, distribution of quality seeds and seed materials of the specific crops in the specific zone is based cropping pattern increase the diversification index.

Sharma and Singh (2013) concluded that diversification has been rendered as a solution and many efforts have been made by the government to achieve the same. But these efforts appear to be diminutive as since the inception of diversification programme no considerable progress has been made. The model of contact farming has been proposed as a tool to encourage crop diversification. Many scholars have argued in favour of Contact farming (CF) that it can reduce the burden of agrarian crisis. But its progress is very slow due to the fact that there are policy factors that still encourage wheat and rice cycle. Serious efforts need to be made to bring changes in the agrarian economy of the state. For this, strong policy framework and public-private partnership should be encouraged in the state.

Sarkar and Das (2014) revealed that under the prevailing conditions of electricity pricing and MSP on rice will remain the most remunerative crop and farmers will not move towards maize cultivation. In the absence of a linkage between the procurement policy and the energy policy that will incentive farmers to use groundwater efficiently, none of the measures to achieve crop diversification are likely to be successful.

Shahbaz (2017) studied the socio-economic characteristics of farmers, determinants of the crop diversification and revealed that diversified farmers were found younger (36 years) as compared to low diversified farmers (45.6 years). further revealed that a farmer having own agricultural equipment such as tractor is more likely to adopt crop diversification. Therefore, the government needs to provide such equipment to the farmers in order to increase crop diversification in the agriculture sector.

Findings of the above studies revealed that, most of the respondents suggested that government should provide recent production technology, market information to farmers regularly, storage facilities, loans through concerned departments and purchase the farmers produce at minimum support price (MSPs).

CHAPTER III

MATERIAL AND METHODS

The research methodology is most important parameter to judge the worth of any research study. Research methodology helps researcher towards the direction of research project. It also acts as a tool in hands of researcher to carry forward the investigation process. After thoroughly studying the available literature, the suitable research methods and appropriate tools were selected to conduct this study. The purpose of this chapter is to describe suitable research tools and methods in conducting this research. The various aspects included in this chapter has been organized under the following sub heads:

3.1 Locale of the study

3.2 Selection of the respondents

3.3 Selection of the variables and their measurement

3.4 Construction of research instrument for data collection

3.5 Pretesting of research instrument

3.6 Finalizing the interview schedule

3.7 Collection of data

3.8 Statistical Analysis of data

3.1 Locale of the study Locale of Experiment:

The study was conducted in the three regions of Punjab i.e *Majha, Malwa, Doaba*. From each region one district Gurdaspur, Bathinda and Jalandhar were randomly selected.

3.2 Selection of the respondents

Six blocks (two from each district) were randomly selected; further twelve villages (two from each block) were randomly selected. From each selected village 15 respondents from non-adopter category and 6 adopters i.e. (2 from each small, medium and large land holding categories) were selected. In this way 21 farmers were selected from each village and total 252 respondents comprised the sample of the study. Out of these 252 respondents 72 respondents were adopter and 180 respondents were non-adopter.

3.3 Selection of variables and their measurement

3.3.1 Independent variables

3.3.1.1 Age

3.3.1.2 Educational qualification

3.3.1.3 Family type

3.3.1.4 Annual income

3.3.1.5 Operational land holding

3.3.1.6 Mass media exposure

3.3.1.7 Social participation

3.3.1.8 Extension contacts

3.3.2 Dependent Variables

3.3.2.1 Opinion

3.3.2.2 Socio-economic reasons

3.3.2.3 Suggestions

3.3.1 Independent variables

3.3.1.1 Age

It referred to the chronological age of the respondents in terms of completed years of life at the time of data collection. The number of completed years has been taken as the score of the variable. Based on this criterion, the respondents were categorized into following three categories by using range method:

Age Category

22-38

39-54

55-70

3.3.1.2 Educational Qualification

It referred to the formal education of the respondents in terms of number of years he/she attended the school/college successfully. The respondents were categorized into six categories.

Category

Illiterate

Primary

Middle

Matric

Senior Secondary

Diploma

Graduate and above

3.3.1.3 Family type

It referred to the type of family to which the respondent belonged i.e. nuclear or joint. Nuclear family means the family in which husband, wife and children living together and joint family means in which husband, wife, their children and parents living together. It was categorized into two categories i.e. nuclear and joint.

Family type

Nuclear

Joint

3.3.1.4 Annual income

It refers to the annual earnings from farming and non-farming occupation. Annual income of respondents was classified into three categories by using range methods.

Income Category

2 - 8 lac

8.01 - 14 lac

14.01 – 20lac

3.3.1.5 Operational land holding

It referred to total area in acres, under crop cultivation by the respondent at the time of data collection. The size of operational land holding was calculated as:

Operational land holding (in acres) = land owned + land leased in – land leased out. The respondents were classified into following five categories given as referred in the Statistical Abstract of Punjab (2015).

Category	Operational Land Holding
Marginal	< 2.5 acres
Small	2.5-5 acres
Semi-medium	5-10 acres
Medium	10-25 acres
Large	> 25 acres

3.3.1.6 Mass media exposure

It referred to the frequency of using different type of media viz. radio, newspapers, television, SMS services, agricultural apps or internet and agricultural magazines by the respondents to gain or improve knowledge. Mass media used by the respondents was measured on a three-point continuum of always, sometimes and never with a score of 3, 2 and 1 respectively. After calculating the mean, ranks were given accordingly.

3.3.1.7 Social participation

It was taken as the part of membership in any Agricultural or Non-agricultural. The respondents were asked about their participation in social organization. Agricultural social organisational such as i.e. *Kisan Club, cooperative society*, farmers organisation etc or Non-agricultural social organisation include village panchayat, religious committee, youth club etc. Social participations of the respondents were measured on a three-point continuum of After one week, After

fortnight, After one month with a score of 3, 2 and 1 respectively. After calculating the mean, ranks were given accordingly.

3.3.1. 8 Extension contacts

It referred to the level of contacts of respondents with extension personnel for seeking information regarding kitchen gardening practices. It was studied on a three point continuum viz., always, sometimes and never with arbitrary scores of 3, 2 and 1 respectively. After calculating the mean, ranks were given accordingly.

3.3.2 Dependent variables

Dependent variables may be defined as the phenomenon or characteristics hypothesized to be the outcome, effect, consequence or output of some input variables. The operational definitions of the selected dependent variables are under:

3.3.2.1 Opinion

It refers to reactions of the farmers regarding crop diversification. It was studied on three-point continuum i.e Agree, disagree and No opinion a score of 3,1,2 was given respectively. After calculating the mean score of individual statement all statements are categorised from lower to higher on the basis of mean.

3.3.2.2 Socio economic reasons

The socio economic reasons such as marketing problems, high cost of production, non-availability of inputs, non -availability of expertise, soil type, distance from market, single crop grown in village, more chance of insect- pest attack, minimum support price, risk taking ability of farmers, lack of knowledge, lack of finance, more labour required, less net returns affects the crop diversification. It was measured after calculating the percentage of individual statements and rank were given accordingly.

3.3.2.3 Suggestions

These are the view-points of the farmers for enhancing the crop diversification and removing the constraints faced by the farmers. It was measured on dichotomous response through open-ended question. It was measured after calculating the percentage and rank were given accordingly

3.4 Construction of research instrument

An interview schedule was considered an appropriate tool for gathering information from respondents about kitchen gardening. It consisted of three parts.

Part I- It included the information about socio-personal characteristics of respondents such as age, education, family type, size of land holding, area under different crops, annual income, mass media exposure, social participation, extension contacts etc.

Part II- It included the information related to opinion of the farmers about crop diversification.

Part III-It included the information related to socio-economic reasons for non-adoption of crop diversification.

Part IV-It included the information related to suggestions of the farmer regarding crop diversification.

3.5 Pretesting of research instrument

Interview schedule so prepared was tested with a sample of 20 respondents from non-sampled farmers for necessary modification.

3.6 Finalizing the interview schedule

To remove the ambiguity, necessary modifications were made based on the difficulty experienced during the pretesting and the suggestions given by the committee members.

3.7 Collection of data

After finalizing the research instrument, the data were collected personally by the researcher by visiting the study area and interviewing the respondents. Proper precautions were taken to ensure unbiased response of the respondents by providing them necessary instructions after explaining the objectives of the study.

3.8 Tabulation and Analysis of data

3.8.1 Tabulation of data

The responses of the respondents were transferred on the master-sheets. Tally sheets and frequency tables were prepared and then analysis was carried out.

3.8.2 Statistical analysis of data

The percentage as well as range method, and mean score were used for descriptive analysis of sample. The relational analysis was conducted through statistical tests below:

3.8.2.1 Mean Score

The arithmetic means or mean score of a set is often computed during data analysis operation. Mean score of respondents were worked out for calculate the discrimination between the socio-economic characteristics of adopters and non-adopters of crop diversification.

$$\bar{X} = \frac{\sum Xi}{N}$$

Where,

\bar{X} = Mean score

X_i = observations score

N = Total number of observations

CHAPTER IV

RESULTS AND DISCUSSIONS

Keeping in view the objectives of the study, results and discussion have been presented in the following order:

4.1 Socio-economic characteristics of the respondent

4.2 Opinion of farmers regarding crop diversification

4.3 Socio-economic reasons for non-adoption of crops diversification

4.4 Suggestion of the farmers regarding crop diversification

4.1 Socio-personal characteristics of the respondents.

The data pertaining to distribution of respondents according to their socio-personal characteristics have been presented in Table 4.1. The details of each of these have been described as under:

4.1.1 Age

The age of the respondents varied from 28-70 years. The data in Table 1 indicate that in case of adopters less than half of the respondents (43.05 per cent) belonged to the category of 22-38 years of age group, whereas 29.16 per cent of the respondents fall under the category of 55-70 years of age group and only 27.78 per cent of the respondents belonged to the category of 39-54 years of age group. While, in case of non-adopters 40.56 per cent belonged to the category of 22-38 years of age group, whereas 27.22 per cent the respondents fall under the category of 55-70 years of age group and only 32.22 per cent of the respondents belonged to the category of 39-54 years of age group. Findings are in conformity with those of Patel *et al* but are contradictory to those of Khule *et al* (2008) and Shashidhar (2004).

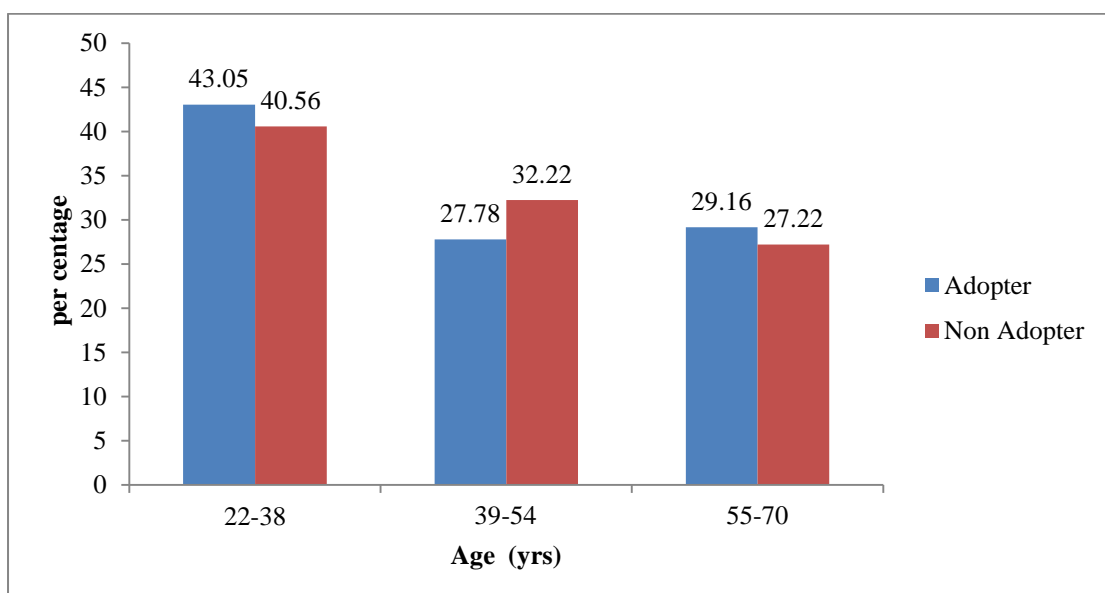


Fig. 1 Distribution of respondents according to their age

Table 1: Distribution of respondents according to their socio-personal characteristics

(n=252)

S. No.	Socio-personal profile	Category	Adopter (n ₁ =72)		Non-adopter (n ₂ =180)	
			f	(per cent)	F	(per cent)
1.	Age (years)	22-38	31	43.05	73	40.56
		39-54	20	27.78	58	32.22
		55-70	21	29.16	49	27.22
2.	Education	Illiterates	0	0	23	12.77
		Matric	21	29.16	60	61.80
		12 th	34	47.22	49	27.22
		Diploma	7	9.73	15	8.33
		Graduate	10	13.89	33	18.33
3.	Type of family	Nuclear	45	62.5	113	62.78
		Joint	27	37.5	67	37.22
4.	Operational Land Holding (acres)	Marginal (< 2.5)	10	13.89	31	17.22
		Small (2.5-5)	14	19.44	49	27.22
		Semi-medium (5-10)	20	27.78	44	24.44
		Medium (10-25)	4	5.56	35	19.44
		Large (>25)	24	33.33	21	11.66

4.1.2 Education

The data presented in Table 1 pertaining to education of the respondents varied from matric to graduate level of education (including diploma). In case of adopters the data show that about half of the respondents i.e. 47.22 per cent were literate having educational qualification upto senior secondary level, 29.16 per cent were matriculate, 13.89 per cent were graduate. While, in case of non-adopters maximum respondents i.e. 61.80 per cent were studied upto matric, 27.22 per cent were literate having educational qualification upto senior secondary level, 18.33 per cent were graduate level and 8.33 per cent had diploma as their educational qualification. Findings are in line with Dhamodaran and Vasanth kumar (2001) and contradictory to those Madhushekar (2009) and Madhu (2010).

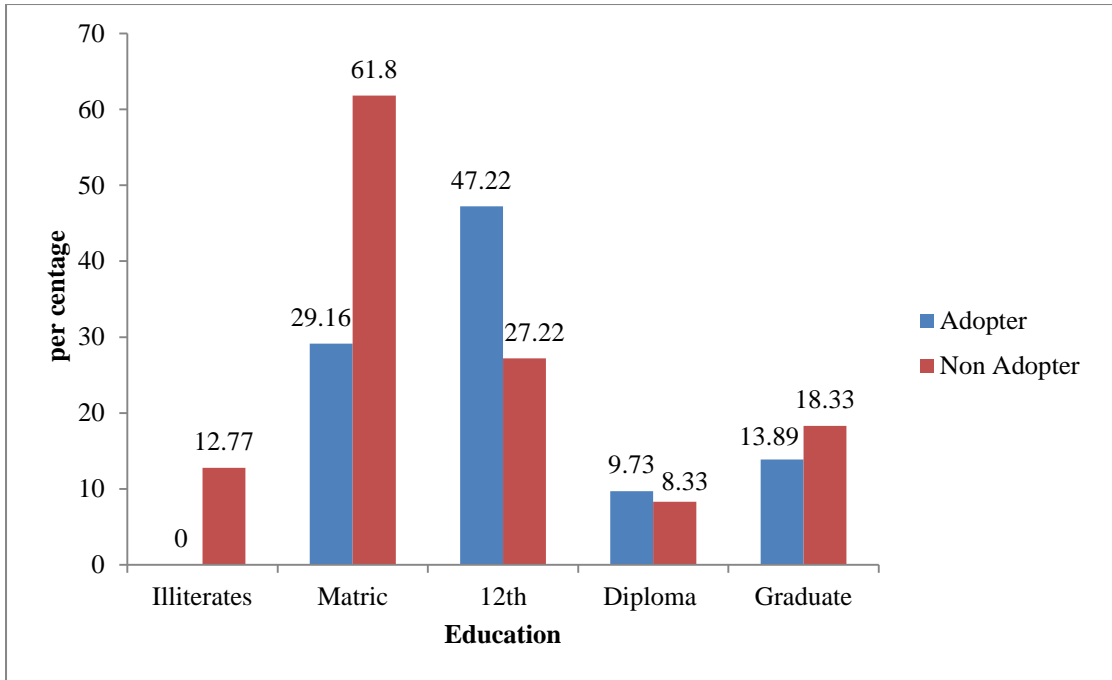


Fig. 2 Distribution of respondents according to their education

4.1.3 Family type

The data pertaining to family type in Table 1 indicate that in case of adopters more than sixty i.e. 62.5 per cent of the respondents belonged to nuclear family whereas 37.50 per cent belonged to joint family, similar trend was observed in non-adopters. 62.78 per cent of the respondents belonged to nuclear family and 37.22 belong to joint family. It may be due to the fact that now a day's joint family system losing its importance.

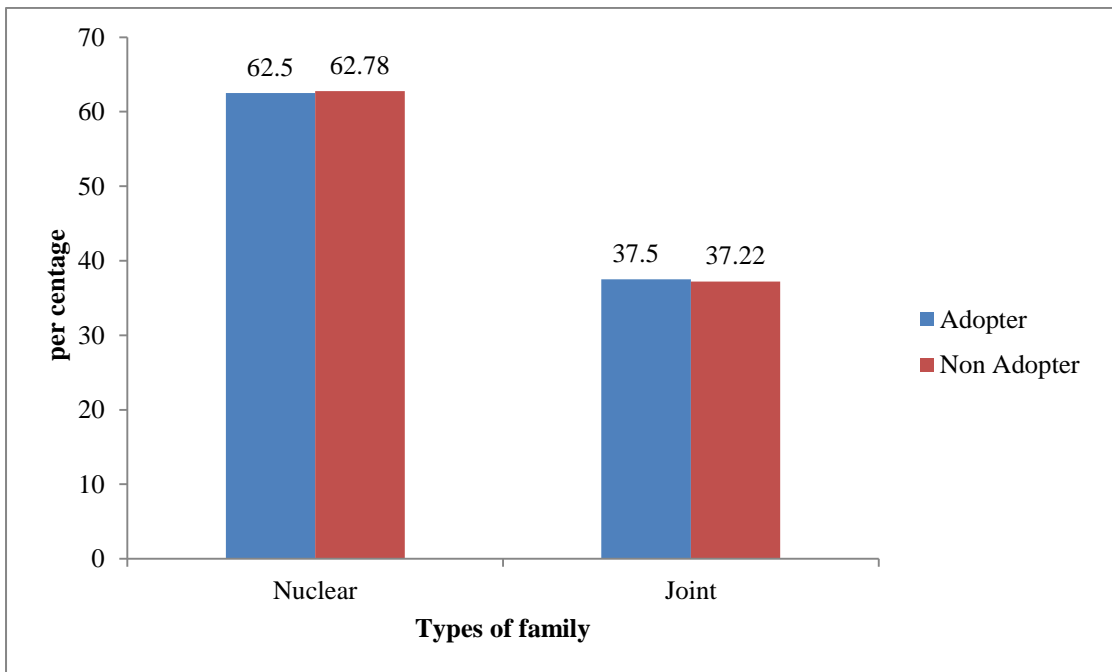


Fig. 3 Distribution of respondents according to their family type

4.1.4 Operational land holding

The respondents were categorized into five groups according to their operational land holding on the basis of Statistical Abstract of Punjab as shown in the Table 1. In case of adopters, the data revealed that 33.33 per cent of the farmers had large (> 25 acres of land holding), followed by 27.78 per cent having semi-medium i.e. 5-10 acres of land holding. About, 20 per cent of respondents having small (2.5-5 acres) operational land holding. Only, 13.89 per cent and 5.56 per cent of them had marginal (less than 2.5 acres) and medium (10-25 acres) operational land holdings respectively. In case of non-adopters, the data show that among the respondents, 24.44 per cent of the farmers had semi- medium i.e. 5-10 acres of land holding, followed by 27.22 per cent having small (2.5-5 acres) operational land holding. About, 20 per cent of respondents had medium (10-25 acres) land holding. Only, 9.44 per cent and 11.66 per cent of them had marginal (less than 2.5 acres) and large (> 25 acres) operational land holdings respectively.

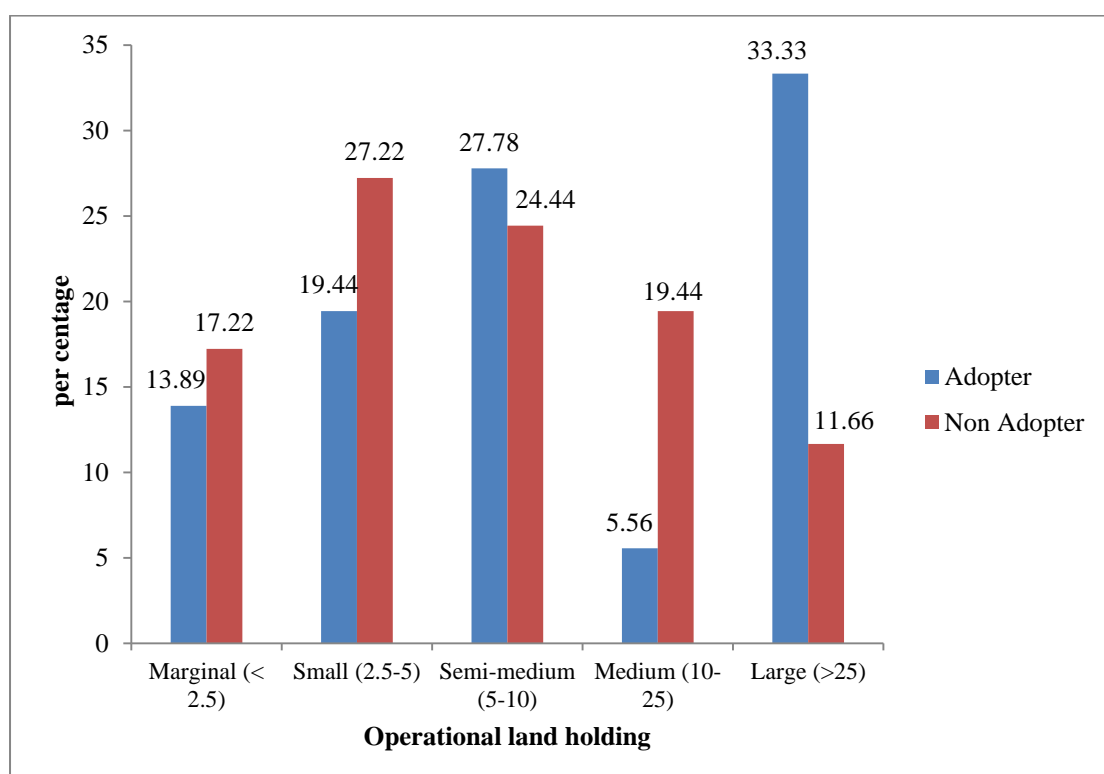


Fig. 4 Distribution of respondents according to their operational land holding

The data pertaining to distribution of adopters and non-adopters according to cropping pattern in Table 2. It reveals that in case of adopters 94.44 per cent had sown berseem, 76.39 per cent had sown wheat, 23.61 per cent had sown sugarcane and only 6.94 per cent of respondents had sown oat as rabi crops in their fields. While, in case of non-adopters 100 per cent had sown wheat, 98.33 per cent had sown berseem, 4.16 per cent had sown oat as their rabi crops in their main field.

Findings are in conformity with those of Shashidhara (2004) and Nagadev and Venkataramaiah (2007) but are contradictory to those of Thiranjangowda (2005).

Table 2: Distribution of respondents according to cropping pattern

(n=252)

S. No	Crops	Adopter f (n ₁ =72)	(per cent)	Non- adopter f (n ₂ =180)	(per cent)
A.	Rabi Crops				
i)	Wheat	55	76.39	180	100
ii)	Berseem	68	94.44	177	98.33
iii)	Oat	5	6.94	3	4.16
iv)	Sugarcane	17	23.61	0	0
B.	Kharif Crops				
i)	Paddy	-	-	180	100
ii)	Cotton	11	15.27	0	0
iii)	Maize	24	33.33	0	0
iv)	Basmati	20	27.77	0	0
v)	Bajra	40	45.83	73	40.55
vi)	Sorghum	32	30.56	104	57.77
C.	Vegetables				
i)	Vegetables	29	40.28	17	9.44

*Multiple response

Further, it is observed that in case of adopters 45.83 per cent had sown bajra, 27.77 per cent had sown basmati, 33.33 per cent had sown maize, 30.56 per cent had sown sorghum and only 15.27 per cent of respondents had sown cotton in kharif seasons. No respondents in adopter category has been found to sow paddy as their main crop. While, in case of non-adopters all of the respondents had sown paddy, 57.57 per cent had sown sorghum and 40.55 per cent had sown bajra as their kharif crops in their main field. Additionally, only 40.28 per cent of the adopters and 9.44 per cent of the respondents in non-adopters' category were found to sow vegetables in their farm land. It was found that adopters were diversified as compared to non-adopters.

In the Table 3 which include other enterprises viz. dairy reveal that more than two third of the adopters (76.39 per cent) had 2-10 animals, 13.88 per cent of respondents had 11-18 animals and only 9.72 per cent had 19-26 animals. Further, in case of non-adopters majority of the respondents (82.22 per cent) had 2-10 animals,

16.67 per cent of respondents have 11-18 animals and merely 1.11 per cent had 19-26 animals.

Table 3: Distribution of respondents according to other enterprises

(n=252)

S. No.	Name	Unit-wise	Category	Adopter (n ₁ =72)		Category	Non-adopter (n ₂ =180)	
				f	(per cent)		f	(per cent)
1.	Dairy	Animal	2-10	55	76.38	2-14	148	82.22
			11-18	10	13.88	15-28	30	16.66
			19-26	7	9.72	29-42	2	1.11

The scrutiny of data in Table 4 revealed that more than half of the family income i.e 65.87 per cent were in the range of 2 lacs to 8 lacs rupees whereas 24.20 per cent were in the range of 8.01 lacs to 14 lacs rupees and only 9.92 per cent were in the range of 14.01 lacs to 20 lacs.

Table 4: Distribution of the respondents according to annual family income

(n=252)

S.No.	Socio-personal profile	Category (Lac)	(n=252)	
			f	(per cent)
1	Family income (Rs/years)	2-8	166	65.87
		8.01-14	61	24.20
		14.01-20	25	9.92

Findings shown in Table 5 reveal that in case of adopters among package of practices related to field crops were most influential than other three as the mean score is 2.56 thus rank first. While, vegetable (with mean score 2.29), mushroom (with mean score 2.04), and horticulture (with mean score 1.34) related practices were ranked as second, third and fourth respectively. Whereas, in case of non-adopters' package of practices related to field crops were most influential than other three as the mean score is 2.08 thus rank first. While, vegetable (with mean score 1.48), mushroom (with mean score 1.24), and horticulture (with mean score 1.22) related package of practices were ranked as second, third and fourth respectively.

Further, in case of adopters among newspaper and magazines the respondents prefer newspaper more than the other four options available as the mean score is 2.77 and thus rank first. While, progressive farming (with mean score 2.51), *krishi jagran* (with mean score 1.93), *kheti duniya* (with mean score 1.80) and modern

Table 5: Distribution of respondents according to Mass Media Exposure

(n=252)

Sources	Adopter (n ₁ =72)					Overall Rank	Non-adopter (n ₂ =180)					Overall rank
	Always f (per cent)	Sometimes f (per cent)	Never f (per cent)	Mean	Rank		Always f (per cent)	Sometimes f (per cent)	Never f (per cent)	Mean	Rank	
1. Print Media												
Package of Practices (PAU)												
Field Crops	10 (13.88)	12 (16.66)	50 (69.44)	2.56	1	6	87 (48.33)	21 (11.67)	72 (40.00)	2.08	1	4
Vegetables	34 (47.22)	25 (34.72)	13 (18.00)	2.29	2	10	25 (13.89)	37 (20.56)	118 (65.56)	1.48	2	9
Mushroom	27 (37.5)	25 (34.72)	20 (27.78)	2.09	3	12	9 (5.00)	31 (17.22)	141 (78.33)	1.24	3	11.5
Horticulture	1 (1.38)	23 (31.94)	48 (66.66)	1.34	4	16	3 (1.67)	38 (21.11)	139 (77.22)	1.22	4	11.5
Magazine												
Progressive Farming/ <i>Changi Kheti</i>	49 (68.05)	11 (15.28)	12 (16.67)	2.51	2	7	82 (45.56)	2 (1.11)	94 (52.22)	1.92	1	7
Modern Kheti	22 (30.55)	12 (16.66)	38 (52.77)	1.77	5	15	36 (20.00)	4 (1.67)	141 (78.33)	1.41	2	10
Kheti Duniyan	11 (15.27)	40 (55.55)	21 (29.16)	1.86	4	14	7 (3.89)	5 (2.78)	168 (93.33)	1.11	4	14

Krishi Jagran	19 (26.38)	29 (40.27)	24 (33.33)	1.93	3	13	14 (7.78)	10 (5.56)	156 (43.33)	1.21	3	13
Newspaper	60 (83.33)	7 (9.72)	5 (6.94)	2.77	1	2	91 (50.56)	11 (6.11)	78 (52.22)	1.91	2	6
2. Electronic Media												
Television	60 (83.33)	5 (6.94)	7 (9.72)	2.73	2	4	105 (58.33)	27 (15.00)	48 (26.67)	2.32	1	1.5
Radio	55 (76.38)	12 (16.67)	5 (6.94)	2.69	3	5	42 (23.33)	47 (26.11)	91 (50.56)	1.72	3	9
Internet	62 (86.11)	8 (11.11)	2 (2.78)	2.83	1	1	63 (35.00)	31 (17.22)	86 (47.78)	1.87	2	8
3. Social Media												
Youtube	36 (50.00)	23 (31.94)	13 (18.05)	2.31	3	9	70 (38.89)	45 (25.00)	65 (36.11)	2.03	3	5
Facebook	39 (54.16)	12 (16.67)	21 (29.16)	2.25	4	11	98 (54.44)	17 (9.44)	65 (36.11)	2.18	2	3
Whatsapp	60 (83.33)	7 (9.72)	5 (6.94)	2.76	1	3	102 (56.67)	34 (18.89)	44 (24.44)	2.32	1	1.5
Mobile App.	46 (63.88)	11 (115.27)	15 (20.83)	2.43	2	8	69 (38.33)	37 (20.56)	74 (41.11)	1.97	4	6

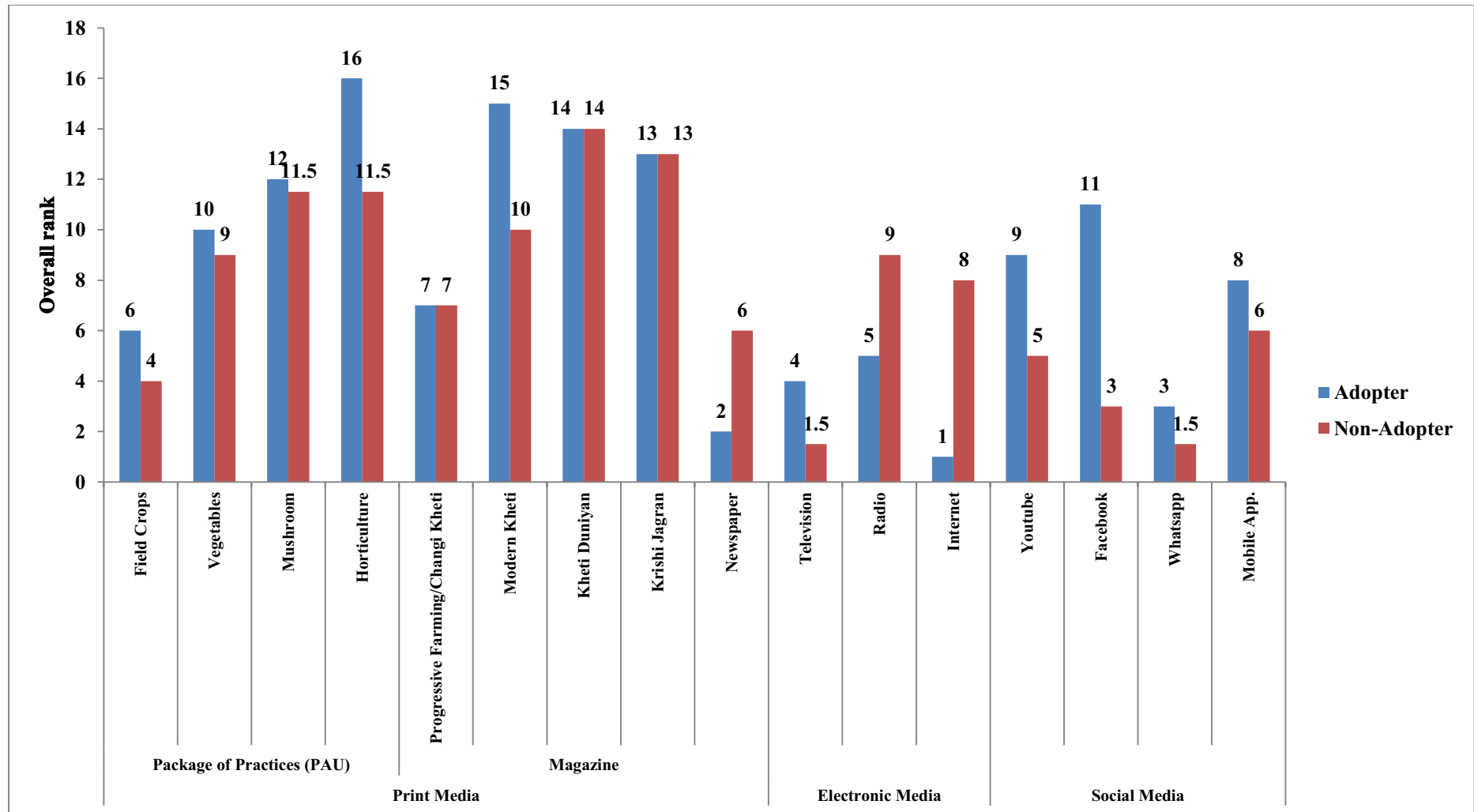


Fig. 5 Distribution of respondents according to Mass Media Exposure

kheti (with mean score 1.77) were ranked 2nd, 3.5th and 5th respectively. Whereas, in case of non-adopters among newspaper and magazines the respondents prefer progressive farming as well as news-paper more with common mean score is jointly 1.91 and thus rank 1.5th. While, modern *kheti* (with mean score 1.41), *krishi jagran* (with mean score 1.21) *kheti duniya* (with mean score 1.11), and were 3rd, 4th and 5th respectively.

Also, in adopter's category among all other electronic media the respondents use internet more than TV and radio as the mean score is 2.83 and thus rank first. While, TV (with mean score 2.73) and internet (with mean score 2.69) ranked 2nd and 3rd respectively. Whereas, in case of non-adopters among electronic media the respondents use TV more than internet and radio as the mean score is 2.32 and thus rank first. While, internet (with mean score 1.87) and radio (with mean score 1.72) ranked 2nd and 3rd respectively. This may be due to fact that majority of the adopters were studied upto senior secondary while majority of non-adopters were studied upto matric.

In addition to this, adopters also use social media for agriculture updates. Among social media whatsapp is most preferred followed by mobile apps, other youtube and facebook. While, most of the non-adopters prefer whatsapp, followed by other facebook, youtube and mobile apps. In both categories of farmers were mostly prefer WhatsApp as a source of mass media because of whatsapp easily accessible to farmers.

According to overall rank wise biggest source of information for the respondents in adopter category was internet with mean score of 2.83 thus rank 1st followed by newspaper with mean score of 2.77 thus rank 2nd. Respondents were also accessing the information from whatsapp and Television which were ranked at 3rd and 4th with mean score of 2.76 and 2.73 respectively. Radio and field crops related package of practices has 5th and 6th position with mean score of 2.69 and 2.56 respectively. Among all the sources of mass media exposure progressive farming and mobile apps were ranked 7th and 8th with the mean score of 2.51 and 2.43. Further, in non-adopter category television and Whatsapp were preferred mostly with mean score of 2.32 thus rank 1.5th followed by facebook with mean score of 2.18 thus rank 3rd. Respondents were keen to access information from field crop related package of practices and Youtube which were ranked at 4th and 5th with mean score of 2.08 and 2.03 respectively. *Krishi jagran* with mean score 1.21 and *kheti duniya* with mean score 1.11 were least preferred by the non- adopters for agricultural information. Findings are contradictory with those of Gupta (1999) and Kanavi (2000).

Table 6: Distribution of respondents according to their Social participation

(n=252)

Adopters (n ₁ =72)							Non-adopters (n ₂ =180)						
S. No	Organization	After one week f (per cent)	After fortnight f (per cent)	After one month f (per cent)	Mean	Rank	Overall Rank	After one week f(per cent)	After fortnight f (per cent)	After one month f (per cent)	Mean	Rank	Overall rank
a)	Agricultural												
i)	Cooperative society	60 (83.33)	5 (6.94)	7 (9.72)	2.73	1	1	89 (55.00)	28 (15.56)	63 (35.00)	2.14	1	2
ii)	Kisan club	50 (69.44)	12 (16.67)	10 (13.89)	2.55	2	2	85 (55.56)	29 (16.11)	66 (36.67)	2.10	2	3
iii)	Farmers organization	45 (62.5)	15 (20.83)	12 (16.67)	2.45	3	4	94 (52.22)	13 (7.22)	73 (40.56)	2.12	3	4
b)	Non- Agricultural												
i)	Village Panchayat	48 (66.67)	11 (15.28)	13 (18.05)	2.48	1	3	79 (51.67)	30 (16.11)	71 (39.44)	2.04	2	5
ii)	Religious Committee	38 (52.78)	22 (30.56)	12 (16.67)	2.36	3	6	104 (60.56)	26 (14.44)	50 (27.78)	2.38	1	1
iii)	Youth Club	39 (54.16)	21 (29.17)	12 (16.67)	2.37	2	5	65 (63.11)	46 (25.00)	69 (47.22)	1.97	3	6

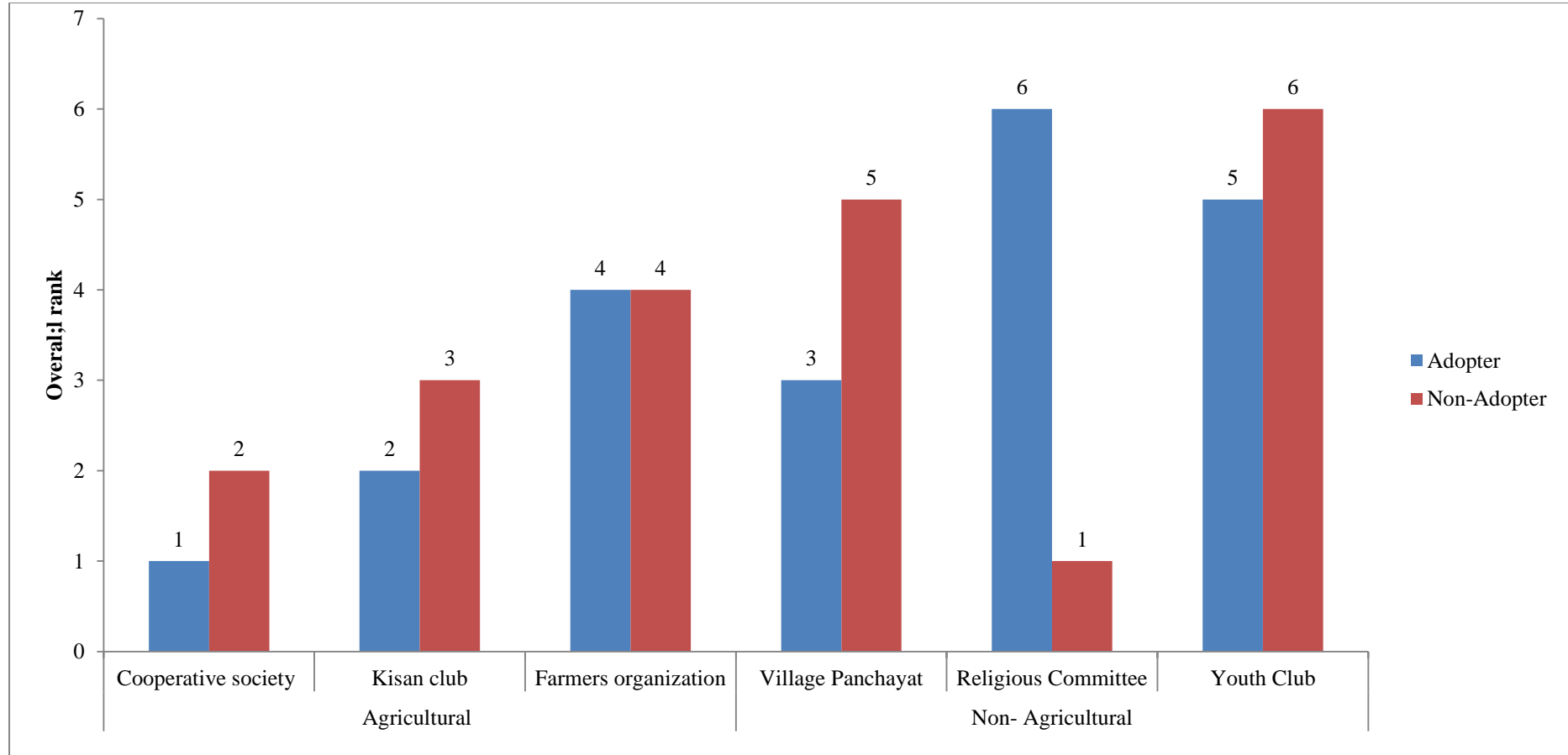


Fig. 6: Distribution of respondents according to their Social participation

Findings shown in the Table 6 suggests that adopters were more participative in cooperative societies (with mean score of 2.73) followed by *Kisan* Club (with mean score of 2.55) and farmers organization (with mean score of 2.45). On the other hand, non-adopters were more participative in cooperative societies (with mean score of 2.14) followed by *kisan* club (with mean score of 2.10) and Farmers' organization (with mean score of 2.12). Further, in non- agricultural participation adopters were more participative in village panchayat (with mean score of 2.48) followed by village youth club (with mean score of 2.37) and religious committee (with mean score of 2.36). On the other hand, non-adopters were more participative in religious committee (with mean score of 2.38) followed by village panchayat (with mean score of 2.04) and youth club (with mean score of 1.97).

According to overall rank, adopters were more participative in cooperative societies (with mean score of 2.73) followed by *Kisan* Club (with mean score of 2.55) and farmers organisation (with mean score of 2.48). On the other hand, non-adopters were more participative in religious committee (with mean score of 2.38), cooperative societies (with mean score of 2,14), farmer organisation (with mean score of 2.12), followed by *kisan* club (with mean score of 2.10), followed by village panchayat (with mean score of 2.04) and Youth club (with mean score of 1.97).

The findings in Table 7 revealed that the adopters were highly influenced with the pesticide dealer having mean score value of 2.56 and ranked 1st, followed by agriculture development officer (with a mean score 2.15) then Scientists of Punjab Agricultural University (mean score value of 1.65). The respondents had also shown inclination towards KVK scientists and NGOs as their mean value is quite high, they were ranked 3rd and 4th. On the other hand, non-adopters had Pesticide dealer as most trustworthy person to get information regarding agriculture (With a mean score 2.53), followed by Progressive Farmers (mean score value of 1.69) and Scientists of Krishi Vigyan Kendras (KVK) (mean score value of 1.68) who were ranked 2nd and 3rd respectively. While, Horticulture Development Officer were least preferred in both the cases for agriculture information. This may be due the fact that adopters and non- adopters were not grown fruit crops and were not interested to make contact with horticulture development officer (HDOs). Findings are in line with those of Venkataramalu (2003) but are contradictory to those of Angadi (2008) and Shashidhar (2004).

4.2 Opinion of farmers regarding crop diversification

It refers to reactions the farmers regarding crop diversification. It was studied on three- point continuum i.e Agree, undecided, disagree and a score of

Table 7: Distribution of respondents according to their Extension Contact

(n=252)

	Sources	Adopter (n ₁ =72)					Non-Adopter (n ₂ =180)				
		Always f (per cent)	Sometime f (per cent)	Never f (per cent)	Mean	Rank	Always f (per cent)	Sometime f (per cent)	Never f (per cent)	Mean	Rank
a)	Agriculture Development Officer	18 (25)	47 (23.61)	7((9.72)	2.15	2	28 (15.55)	53 (29.44)	99 (55.00)	1.60	6
b)	Horticulture Development Officer	6 (8.33)	11(15.28)	55 (76.38)	1.31	7	4 (2.22)	49 (27.22)	127 (70.55)	1.31	7
c)	Scientists of Punjab Agricultural University, Ludhiana	8(11.11)	31(43.05)	33(45.83)	1.65	3	22 (11.67)	71 (39.44)	87 (48.33)	1.62	4
d)	Scientists of Krishi Vigyan Kendras (KVK)	5(6.94)	29(40.27)	39(54.16)	1.55	4.5	28 (15.56)	67 (37.22)	85 (47.22)	1.68	3
e)	Progressive Farmers	9(12.5)	11(15.28)	52 (72.22)	1.40	6	44(25.56)	37 (23.33)	99 (56.67)	1.69	2
f)	Pesticide dealer	41(56.94)	25(34.72)	3 (4.1)	2.56	1	102 (56.66)	73 (40.56)	5 (2.7)	2.53	1
g)	Non- government organization (NGO)	11(15. 28)	18 (25)	43 (59.72)	1.55	4.5	40 (22.22)	30 (16.67)	110 (61.11)	1.61	5

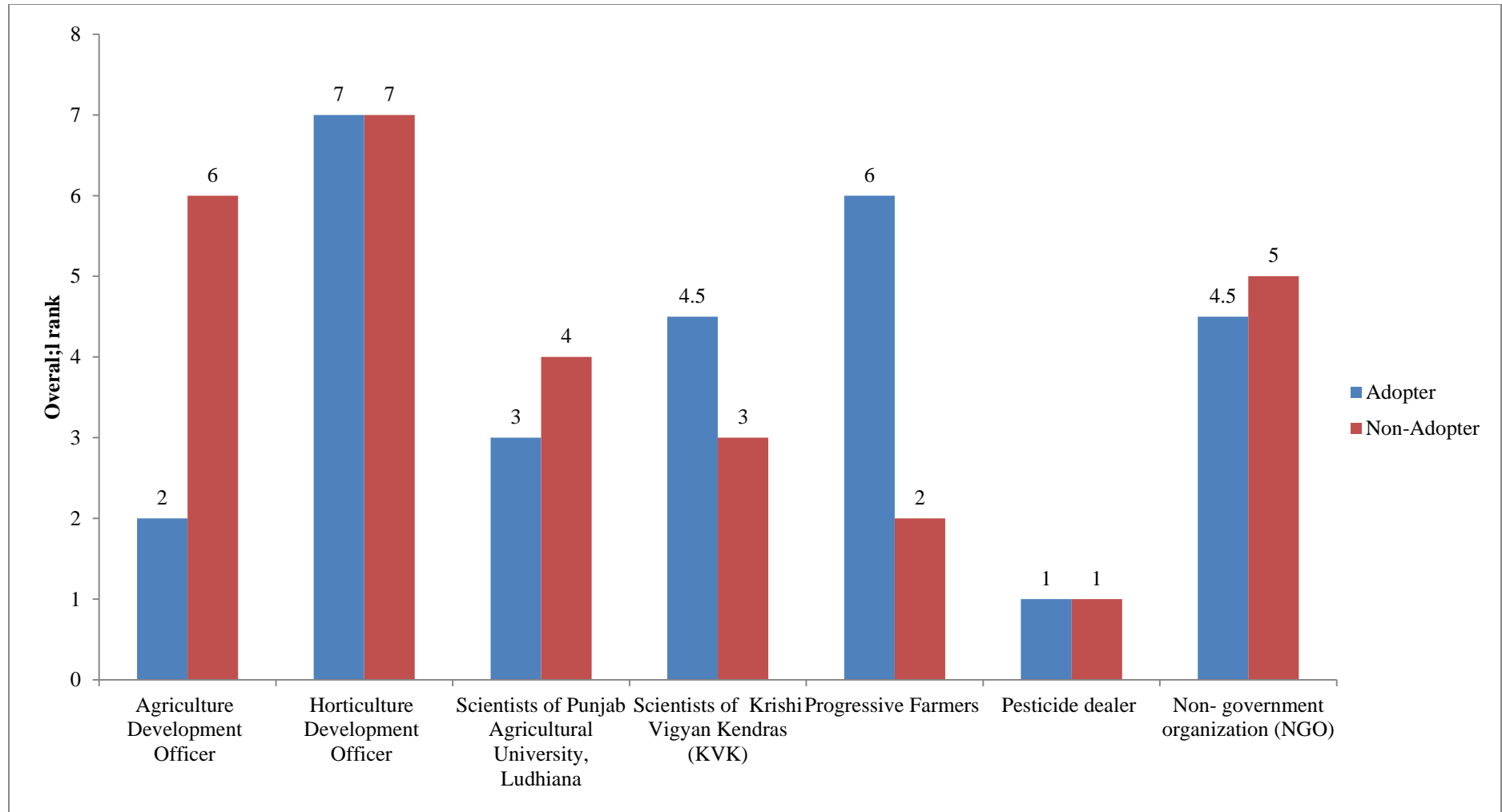


Fig. 7 Distribution of respondents according to their Extension Contact

Table 8: Distribution of respondents according Opinion regarding crop diversification

		Adopter (n₁=72)				Non -adopter (n₂=180)			
	Item	Agree f(per cent)	Disagree f (per cent)	No opinion f (per cent)	Mean	Agree f(per cent)	Disagree f (per cent)	No opinion f (per cent)	Mean
1.	Crop diversification involves high risk	18 (25)	13 (18.05)	41 (56.94)	2.06	38 (22.78)	3 (1.11)	139 (78.33)	2.19
2.	Crop diversification helps to increases net return/profit	39 (54.16)	16 (22.22)	17(23.61)	2.31	48 (25.00)	3 (1.67)	129 (71.67)	2.25
3.	Crop diversification enhances groundwater table	37(51.38)	17 (23.61)	18(25.00)	2.27	41 (23.89)	3(2.22)	136(74.44)	2.21
4.	Crop diversification helps to raise nutritional level in our daily diet	35(48.61)	13 (18.05)	24(33.33)	2.30	51 (28.33)	2 (1.11)	127 (68.89)	2.27
5.	Crop diversification reduces air pollution, which occurs due to various agricultural activities	22 (30.55)	7 (9.72)	43 (59.72)	2.20	45 (23.89)	21 (6.11)	114 (63.33)	2.13
6.	Crop diversification helps to control weeds problems	17 (23.61)	11(15.28)	44 (61.11)	2.23	48 (22.22)	12 (6.67)	120 (66.67)	2.20
7.	Crop diversification helps to control various insects and diseases	21(29.16)	14(19.44)	37 (51.33)	2.09	38 (21.11)	6 (2.22)	136 (75.57)	2.18
8.	Crop diversification helps in adoption of new technologies and practices	21 (29.16)	19 (26.38)	32 (44.44)	2.02	50 (27.78)	5 (2.78)	125 (69.44)	2.25

9.	Crop diversification helps to promote sustainable agriculture	25 (34.72)	21(29.17)	26 (36.11)	2.05	66 (37.22)	39 (21.67)	75 (42.22)	2.15
10.	Cultivation of crops (less water consuming) other than paddy and wheat leads to increase the soil fertility	45 (62.5)	12 (16.67)	15 (20.83)	2.42	111 (66.11)	12 (6.67)	57 (31.67)	2.55
11.	Training necessary to promote crop diversification	36 (50)	9(12.5)	27 (37.5)	2.13	96(54.44)	5 (2.78)	79 (43.89)	2.50
12.	Breaking of paddy - wheat crop rotation cycle is a challenging task	38 (52.78)	10 (13.89)	24 (33.33)	2.19	93 (55.56)	5 (2.78)	82 (45.56)	2.49
13.	Implementation of minimum support price will promote crop diversification	41 (56.94)	11(15.28)	20 (27.78)	2.29	96 (53.33)	12 (6.67)	72 (40.00)	2.47
14.	Input subsidies on crops other than paddy and wheat, will encourage farmers to diversify their farming	43 (59.72)	9(12.5)	20 (27.78)	2.32	80 (50.00)	31 (17.22)	69 (41.11)	2.27
15.	On assured marketing of the produce of all crops, I will move for crop diversification					132 (73.33)	3 (1.66)	45(28.89)	2.71

3,2,1 was given respectively. A total score from each respondent was calculated and divided into three categories based on range method.

A scrutiny of the data in Table 8 indicate that the adopters were aware about the cultivation of crops that need less water (other than paddy and wheat leads to increase the soil fertility) followed by assured marketing of the produce of all crops and input subsidies on crops other than paddy and wheat implementation of minimum support price these all are the most prevalent options that make their mind set to opt for crop diversification. While, in case of non-adopters, assured marketing of the produce of all crops followed by cultivation of crops that require less water, training is necessary to promote crop diversification and implementation of minimum support price MSPs. These all are the most prevalent options that make their mind set to opt for crop diversification. Whereas, crop diversification helps to control various insects and diseases and crop diversification involve high risk were least preferred by non- adopter. Findings are in line with those of Renuka (1982).

Table 9: Distribution of non-adopter according to preference, for adoption of crop rotation other than wheat-rice

(n₂=180)

Sr.no	Crop rotations	f*	(per cent)
1	Maize – wheat	144	79.44
2	Maize –potato- wheat	89	49.44
3	Moong- wheat	23	12.78
4	Basmati- wheat	133	73.89
5	sugarcane-maize	61	33.89
6	Maize-wheat-moong	49	27.22
7	Maize-potato/toria-sunflower	23	12.78
8	Maize-potato-summer moong	79	43.89
9	Maize-potato-mentha	37	20.56
10	Cotton- barseem/oats	54	30.00
11	Cotton-wheat	59	32.78
12	Sugarcane- wheat	55	30.56
13	Vegetables (okra, pumpkin etc.)-Wheat-bajra (fodder)	68	37.78
14	Maize-wheat-bajra(fodder)	135	75.00
15	Maize/cotton-senji-sugercane-ratoon 1-ratoon 11-wheat	87	48.33
16	Maize-gram	24	13.33
17	Desi Cotton-lentil	13	7.22
18	Soyabean-wheat	7	3.89

*Multiple response

An overview of the preference provided for adoption of crop rotation and majority of the non-adopters were mostly preferred to grow alternative crop rotations were Maize- wheat (79.44 per cent), Maize-wheat-bajra (75.00 per cent) then basmati – wheat (73.89 per cent), Maize –potato- wheat (49.44 per cent), Maize/cotton-*senji*-sugarcane-ratoon 1-ratoon-wheat (48.33 per cent), Maize-potato-summer moong (43.89 per cent), Vegetables (okra, pumpkin etc.)-Wheat-bajra (37.78 per cent), sugarcane-maize (33.89 per cent), Cotton-wheat (32.78 per cent), Sugarcane- wheat (30.56 per cent) and Cotton- berseem/oats (30.00 per cent). While, Desi Cotton-lentil (7.22 per cent) and Soyabean-wheat (3.89 per cent) were least preferred to grow as alternative crop rotations.

Table 10: Distribution of non- adopters according to different Socio-Economic reasons for non-adoption of crop diversification

(n ₂ =180)			
	Statements	f*	per cent
I.	Economic reasons for non-adoption		
A.	Inputs related reasons		
1.	Lesser availability of inputs in case of alternative crops;		
a)	Seed	101	56.11
b)	Fertiliser	98	54.44
c)	Labour	132	73.33
d)	Bio pesticide and bio fertilisers	104	57.78
e)	Irrigation facility	98	54.44
2.	Lesser availability of package of practices	139	77.22
3.	Lesser availability of HYV in case of alternative crops	101	56.11
4	More labour is required for harvesting of vegetables crops	103	57.22
B.	Cost related reasons		
1.	High cost of production in case of alternative crops	111	61.67
2.	High cost of vegetable seeds, pesticides and fertilizers	101	56.11
3.	Lesser availability of specialized expertise	99	55.00
C.	Production related reasons		
1.	Production of crops other than rice and wheat is not easy	122	67.77
2.	Yield of other crops is not sure as of wheat and paddy	117	65.00

3.	More risk involved in case of alternative crops as compare to rice- wheat	101	56.11
D.	Market and income related reasons		
1.	Lack of marketing infrastructure	167	92.77
2.	Lack of minimum support price (MSP) in case of other crops	173	96.11
3	Shattering of pulses, oilseed and net return is low	109	60.56
4	Marketing is not sure in case of vegetables, pulses and oilseeds as of rice and wheat	165	91.67
5.	Diversify agriculture has low income as compare to rice-wheat rotation	83	46.11
6.	Demand of other crops is low as compare to rice and wheat	72	40.00
7	Price fluctuation and net return in very low in case of vegetables and fruit crops	138	76.67
8	More money required for diversifying farming	104	57.78
9	Lack of government loan or subsidy for diversify agriculture	95	52.78
II.	Social reasons for non-adoptions		
1	Due to fragmentation of land holding farmers are stuck into rice-wheat monoculture	51	28.33
2.	Other crops rather than rice and wheat are not suitable to environment	11	6.11
3.	Youth is getting away from agriculture	134	74.74
4.	More hard work is required for the successful establishment of other enterprises in agriculture	111	61.67
III.	Other reasons for non-adoptions		
1	Lack of technical know-how and training	104	57.78
2	Lesser availability of equipment and other inputs	82	45.56
3.	Priority to rice-wheat crops	86	47.78

The findings in Table 10 revealed that the various economic reasons for non-adoption of crop diversification were lack of minimum support price (96.11 per cent), lack of marketing facilities in case of other crops (92.77 per cent), marketing is not sure in case of pulses and oilseeds as of rice and wheat (91.67 per cent), Lesser availability of package of practices (77.22 per cent), price fluctuation and net return is very low in case of vegetables crops (76.67 per cent) lesser

availability of labour in case of alternatives (73.33 per cent), production of crops other than paddy and wheat is not easy (67.77 per cent), high cost of production in case of alternative crops (61.67 per cent), shattering of pulses, oilseeds and net return is low (60.56 per cent), more labour is required for harvesting of vegetables crops (57.22 per cent), high cost of vegetables seeds, pesticides and fertilisers (57.22 per cent), more risk involved in case of other crops as compare to rice-wheat (56.11 per cent), lesser availability of specialized expertise (55.00 per cent). Whereas, social reasons that hinder the adoption of crop diversification were youth is going away from agriculture (74.74 per cent), more hard work is required for the successful establishment of other enterprises in agriculture (61.67 per cent), due to fragmentation of land holding farmers are stuck into paddy-wheat monoculture (28.33 per cent). Other reason that took away adoption of crop diversification were lack of technical know- how (57.78 per cent), followed by non- availability of equipment's and other inputs (45.56).

Findings are line with those of Thakur *et al* (1994), Mohapatra (1999) and Naik (2012) and contradictory to Ravishankar and Kattepa (2012)

Table 11: Suggestions given by respondents for enhancing crop diversification*

(n=252)

S.No	Suggestions	f*	(per cent)
1	Provide Minimum support price (MSPs) on all crops	242	96.03
2	Provide training in other enterprises	35	13.88
3	Provide Proper storage infrastructure and marketing place for other crops	187	74.20
4	Provides loans to small and marginal farmers at low rate of interest	88	34.92
5	Provide inputs for other crops through cooperative societies	212	84.12
6	Provide subsidies on inputs, especially in case of maize and pulses	180	71.42
7	Establish farmers mandi for sale of produce	65	25.79
8	Establish crops processing unit	18	7.142
9.	Training programme to motivate farmers for adoption of other agricultural occupations	155	61.50

*Multiple response

In the Table 11 various suggestions for enhancing the adoption of crop diversification were provided by the non-adopters, most of them were government should provide Minimum Support Price on all crops followed by government provides inputs like seed, fertilizer, insecticide for other crops through cooperative societies then government should provide proper storage infrastructure as well as marketing place for others crops and government directly provide subsidies on inputs to farmers especially in case of maize and pulses crops. They believe that these, suggestions were giving more impact in the adoption of crop diversification. Although, there were some of the points like government should established crops processing unit for the benefit of farmers and training is necessary in case of other enterprises on which they were least agreed to suggest them to implement. Findings are in line with those of Atibudhi (1998), Malik and Singh (2002) and Mohapatra *et al* (2009).

CHAPTER V

SUMMARY

Crop diversification is one of the most important alternatives for farmers that can lead to improve the health of soils and prevents deterioration of ground water. Traditionally, agricultural diversification is said to be a subsistence kind of farming where the farmers were cultivating varieties of crops on their land and undertaking several enterprises on farm. Household food and income security were the basic objectives of agricultural diversification. During the recent period increase in area under the high value commodities is being referred as agricultural diversification. Crop diversification has gained large attention from recent years in Punjab due to monoculture of crops and fixed crop rotations practiced by the farmers year after year. The rice-wheat cropping pattern in the State of Punjab create some serious issue related to agriculture such as, decline in the water table, deterioration of soil fertility, loss of biodiversity, and microorganism and emergence of new insect pest. Farmers of the Punjab intensively use fertilizer and pesticides especially in case paddy crops which lead to deterioration of ground water table and soil fertility. In view of these facts the study was planned with the following specific objectives:

1. To study the opinion of farmers regarding crop diversification
2. To analyze socio-economic reasons for non-adoption of crop diversification
3. To seek suggestions of farmers about adoption of crop diversification.

The study was conducted in the three region of Punjab i.e *Majha, Malwa, Doaba*. From each region one district Gurdaspur, Bathinda and Jalandhar respectively selected selected. From each selected district two blocks were randomly selected and further from each block two villages were randomly selected. From randomly selected village 15 farmers who were growing rice-wheat and 6 farmers who were growing crops other than rice- wheat were selected. In this way a 6 adopter and 15 non- adopters were selected from each village and total 21 respondents were selected from each village. Thus, a total sample constitute 252 respondents, out of these 252 respondents, 72 respondents were adopters and 180 respondents were non- adopter.

Salient findings

Findings of the study revealed majority of respondents (adopters and non-adopters) belonged to 22-38 younger age. Almost all the adopters and non-adopters were male because in Punjab most of the male doing farming on the farm portfolio. Nearly half of the adopters had educational qualification up-to senior secondary level. While majority of the non-adopters had matric level of education. Almost an equal number of respondents adopters and non-adopters (62 per cent) belonged to

nuclear family. Nearly one third of the adopters (33.33 per cent) had large (> 25 acres of land holding). While, in case of non-adopters' majority of the farmers (27.22 per cent) falls under small land holding category.

A large of the adopter (94.44 per cent) had sown berseem as fodder crops. While all the non-adopters had sown wheat as their major rabi crops. A little half of the adopters (45.83 per cent) had sown bajra in kharif season. As many as of the adopters (42.28 per cent) and very few non-adopters (9.44 per cent) were found to sow vegetables in their main field.

More than two third of the adopters (76.38 per cent) had 2-10 animals. Further, in case of non-adopters' majority (82.22 per cent) had 2-14 animals. Majority (65.87 per cent) of the adopters and non-adopters had earned 2-8 lacs rupees.

In case of adopters' field crops related package of practices, Whereas, in case of non-adopters similar to adopter field crop related package of practices were most influential. Further, in case of adopters the respondents preferred newspaper. Whereas, in case of non-adopters the respondents preferred newspaper as well as progressive farming. Also, in adopters' category while using electronic media the respondents use internet. Whereas, in case of non-adopters the respondents use TV. In addition to this, adopters also use social media for agriculture updates. Among social media WhatsApp is preferred mostly by the non-adopters. In adopter category internet was preferred whereas, in non-adopter category television and WhatsApp were preferred mostly.

The adopters and non-adopters were having high participation in agriculture cooperative societies. In non-agricultural participation adopters were more participative in village panchayats, On the other hand, non-adopters were more participative in religious committee. The adopters as well as non-adopters were highly influenced with the pesticide dealers as they are the most trustworthy person to get information regarding agriculture.

The adopters were aware about the cultivation of crops that need less water (other than paddy and wheat leads to increase the soil fertility) followed by input subsidies on crops other than paddy and wheat, implementation of minimum support price will promote crop diversification these all are the most prevalent options that make their mind set to opt for crop diversification. While, in case of non-adopters, assured marketing of the produce of all crops followed by cultivation of crops that require less water consuming, these all are the most prevalent options that make their mind set to opt for crop diversification. The preference provided for adoption of crop rotation followed by the non-adopters were mostly maize - wheat followed

by Maize-wheat-bajra (fodder) then basmati- wheat, Maize –potato- wheat, Maize/cotton-*senji*-sugarcane-ratoon 1-ratoon-wheat.

The various economic reasons for non-adoption of crop diversification were found that lack of marketing facilities, lack of minimum support price (MSP) in case of other crops then marketing is not sure in case of pulses and oilseeds as of rice and wheat. Whereas, social reasons that hinder the adoption of crop diversification were more hard work is required for the successful establishment of other enterprises in agriculture and thus, youth is getting away from agriculture because they want more money in less time. Other reason that took away adoption of crop diversification were lack of technical know-how and training followed by more skill is required for diversify farming and non-availability of equipment and inputs.

Various suggestions for enhancing the adoption of crop diversification were provided by the non-adopters, these were providing Minimum Support Price on all crops followed by provision of inputs like seeds, fertilizers, insecticides for other crops through cooperative societies followed by provision of proper storage infrastructure as well as marketing place for others crops and government should provide subsidies on inputs to farmers especially in case of maize and pulses crops. Farmers believe that these suggestions were given more impact in the adoption of crop diversification.

Limitations of the study

The limitations of the study are given as follows:

1. The findings of the study are based on the expressed opinion of the respondent. Although every effort was made to get accurate information from the respondent, the possibility of a respondent giving some biased information cannot be completely ruled out since some vital information could have been kept back.
2. Being a single student project, it has all those limitations which are very common in such cases, i.e. the limitation of time, money and resources.
3. The study was limited to the three districts of Punjab i.e. Gurdaspur, Jalandhar and Bathinda.

Conclusion

Findings of the study revealed that majority of the respondents opined that crop diversification helped in increase net return, enhances ground water table, raise nutritional value in our daily diet, to control various insects' pests, diseases, weed problems and enhances sustainable agriculture. The reasons for non-adoption of crop diversification were lack of market infrastructure, risk involve in production of alternative crops, high cost of production, lesser availability of labour, fertilisers,

bio pesticides, scarcity of specialized expertise and yield of alternative crops is not sure. Majority of non-adopters were preferred to grow maize-wheat crop rotation if provision of assured markets for the maize crop. It can be concluded from findings of the study provision of basic inputs, assured marketing, and minimum support price (MSPs) on all alternative crops to uplift the crop diversification index in state of Punjab.

Suggestions

- The government should make arrangements for assured marketing of alternative crops like maize, cotton, sugarcane, pulses, oilseeds and vegetables.
- The government should strengthen the storage infrastructure for alternative crops.
- Proper implementation of centralized crop insurance scheme and provision of compensation to farmers in undesirable circumstances like weather calamities, insect pest attack etc.
- Government should install processing unit for the processing of alternative crops.
- There is need of innovation in agricultural machinery, so that farmers can easily plant and harvest alternative crops like maize, pulses, oilseeds and vegetables
- Training should be imparted regarding technical problems associated with cultivations of alternatives crops.
- Special motivational programme should be organised for farmers, so that more farmers get attracted towards alternative crops.

Suggestions for future research

- Similar study can be conducted in other districts of Punjab
- Study can be conducted on all aspects of agricultural diversification because in this study only crops related aspects of diversification was covered.
- The opinion of farmers related to allied areas of agriculture can be studied.

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APPENDIX-I

PART-I

Socio – Personal Characteristics of Farmers (Respondent)

1. Name :
- Village :
- Tehsil :
- Contact Number :
- Father name :
- Block :
- Districts :
2. Age (years) :
3. Education :
4. Operational land holding

		Area (In acre)
(a)	land owned	
(b)	learned in	
(c)	learned out	
	Total (a+b+c)	

5. Crops grown by you during last 5 years (2012-17)

	Crops	Area in acres
A.	Rabi Crops	
i)	Wheat	
ii)	Barley	
iii)	Gram	
iv)	Winter Maize	
v)	Lentil	
vi)	Mustard	
vii)	Raya	
viii)	Berseem	

ix)	Lucrene	
x)	Senji	
xi)	Any other	
B.		
i)	Toria	
ii)	Sunflower	
iii)	Any other	
C.		
i)	Paddy	
ii)	Maize	
iii)	Cotton (American)	
iv)	Cotton (Desi)	
v)	Bajra	
vi)	Mash	
vii)	Arhar	
viii)	Soyabeen	
ix)	Groundnut	
x)	Til	
xi)	Guar	
xii)	Jawar	
xiii)	Any other	
D.		
i)	Sathi Moong	
ii)	Sathi Mash	
iii)	Any other	
E.	Vegetables	
	Rabi	
	Kharif	
F.	Forestry Crops	
G.	Horticulture Crops	

G. Other enterprises (if any)

	Name	Unit-wise
(a)	Diary	
(b)	Poultry	
(c)	Piggery	
(d)	Fishery	
(e)	Mushroom	
(f)	Nursery	
(g)	Other specify	

6. Total annual income of family known from all sources _____ Rs/year

7. Mass Media Exposure

How often do you read, listen or view the following sources for getting information about agriculture:

Sr. No.	Sources	Always	Sometimes	Never
a)	Print Media			
i)	Package of Practices			
*	Field Crops			
*	Vegetables			
*	Mushroom			
*	Horticulture			
ii)	Magazine			
*	Progressive Farming/ <i>Changi Kheti</i>			
*	Modern Kheti			
*	Kheti Duniyan			
*	Krishi Jagran			
*	Agriculture Today			
iii)	Newspaper			
b)	Electronic Media			
i)	Television			
ii)	Radio			
iii)	Internet			

c)	Social Media			
i)	Youtube			
ii)	Facebook			
iii)	Whatsapp			
iv)	Mobile App.			
*				
*				
*				
d)	Any other (Please Specify)			

8. Social participation

How often do you read, listen or view the following sources for getting information about agriculture:

S.No.	Organization	Always	Sometimes	Never
1.	Panchayats			
2.	Cooperative society			
3.	Farmer clubs			
4.	Youth Club			
5.	Religious Committee			
6.	Any other			

9. Extension Contact

Please specify how many times you have met the following sources for getting the latest information regarding agriculture.

	Sources	Always	Sometime	Never
a)	Agriculture Development Officer			
b)	Horticulture Development Officer			
c)	Scientists of Punjab Agricultural University, Ludhiana			
d)	Krishi Vigyan Kendras			
e)	Progressive Farmers			
f)	Pesticide dealer			
g)	Any other (specify)			

PART-II

Opinion of the farmer regarding crop diversification

Item	Agree	Disagree	No opinion
1. Crop diversification involves high risk			
2. Crop diversification helps to increase net return/profit			
3. Crop diversification enhances groundwater table			
4. Crop diversification helps to raise nutritional level in our daily diet			
5. Crop diversification reduces air pollution, which occurs due to various agricultural activities			
6. Crop diversification helps to control weeds problems			
7. Crop diversification helps to control various insects and diseases			
8. Crop diversification helps in adoption of new technologies and practices			
9. Crop diversification helps to promote sustainable agriculture			
10. Cultivation of crops (less water consuming) other than paddy and wheat leads to increase the soil fertility			
11. Training necessary to promote crop diversification			
12. Breaking of paddy - wheat crop rotation cycle is a challenging task			
13. Implementation of minimum support price will promote crop diversification			
14. Input subsidies on crops other than paddy and wheat, will encourage farmers to diversify their farming			
15. On assured marketing of the produce of all crops, I will move for crop diversification			

If assured minimum support price (MSPs) should be given by government than which of the crop rotation you should follow:

Sr.no	Crop rotations (for example)
1	Maize – wheat
2	Maize –potato- wheat
3	Moong- wheat

4	Basmati- wheat
5	sugarcane-maize

PART-III

Socio-Economic reasons for non-adoption of crop diversification

S. No.	Statements	Yes	No
I.	Economic reasons for non-adoption		
A.	Inputs related reasons		
1.	Lesser availability of inputs in case of alternative crops;		
a)	Seed		
b)	Fertiliser		
c)	Labour		
d)	Bio pesticide and bio fertilisers		
e)	Irrigation facility		
2.	Lesser availability of package of practices		
3.	Lesser availability of HYV in case of alternative crops		
4	More labour is required for harvesting of vegetables crops		
B.	Cost related reasons		
1.	High cost of production in case of alternative crops		
2.	High cost of vegetable seeds, pesticides and fertilizers		
3.	Lesser availability of specialized expertise		
C.	Production related reasons		
1.	Production of crops other than rice and wheat is not easy		
2.	Yield of other crops is not sure as of wheat and paddy		
3.	More risk involved in case of alternative crops as compare to rice- wheat		

D.	Market and income related reasons		
1.	Lack of marketing infrastructure		
2.	Lack of minimum support price (MSP) in case of other crops		
3	Shattering of pulses, oilseed and net return is low		
4	Marketing is not sure in case of vegetables, pulses and oilseeds as of rice and wheat		
5.	Diversify agriculture has low income as compare to rice-wheat rotation		
6.	Demand of other crops is low as compare to rice and wheat		
7	Price fluctuation and net return in very low in case of vegetables and fruit crops		
8	More money required for diversifying farming		
9	Lack of government loan or subsidy for diversify agriculture		
II.	Social reasons for non-adoptions		
1	Due to fragmentation of land holding farmers are stuck into rice-wheat monoculture		
2.	Other crops rather than rice and wheat are not suitable to environment		
3.	Youth is getting away from agriculture		
4.	More hard work is required for the successful establishment of other enterprises in agriculture		
III.	Other reasons for non-adoptions		
1	Lack of technical know-how and training		
2	Lesser availability of equipment and other inputs		
3.	Priority to rice-wheat crops		

PART-IV

Farmers suggestions for enhancing the adoption of crop diversification

Sr. No.	Item	Farmers suggestion
1.	Inputs availability in crops (Field crops, Pulses, Vegetables, Horticultural and Oil\seed)	
a)	Seed availability	
b)	Fertilizer availability	
c)	Water availability irrigation	
d)	insecticide and pesticides availabilities	
(B)	Inputs availability in other enterprise	
a)	Dairy	
b)	Poultry	
c)	Piggery	
d)	Mushroom	
e)	Nursery	
f)	Bee keeping	
g)	Any other (specify)	
2.	Related to production technology	
(A)	Inputs availability in crops (Field crops, Pulses, Vegetables, Horticultural and Oil\seed)	
(B)	In case of other enterprises	
a)	Dairy	
b)	Poultry	
c)	Piggery	
d)	Mushroom	
e)	Nursery	
f)	Bee keeping	
g)	Any other (specify)	
(3)	Harvesting and post harvest handling	
(A)	In case of crops (Field crops, Pulses, Vegetables, Horticultural and Oil\seed)	
(B)	In case of other enterprise	

a)	Dairy	
b)	Poultry	
c)	Piggery	
d)	Mushroom	
e)	Nursery	
f)	Bee keeping	
g)	Any other (specify)	
4.	Storage related	
(A)	In case of crops (Field crops, Pulses, Vegetables, Horticultural and Oil\seed)	
(B)	In case of other enterprise	
a)	Dairy	
b)	Poultry	
c)	Piggery	
d)	Mushroom	
e)	Nursery	
f)	Bee keeping	
g)	Any other (specify)	
5.	Value addition and processing	
(A)	In case of crops (Field crops, Pulses, Vegetables, Horticultural and Oil\seed)	
(B)	In case of other enterprise	
a)	Dairy	
b)	Poultry	
c)	Piggery	
d)	Mushroom	
e)	Nursery	
f)	Bee keeping	
g)	Any other (specify)	
6.	Marketing	
(A)	In case of crops (Field crops, Pulses, Vegetables, Horticultural and Oil\seed)	
(B)	In case of other enterprise	
a)	Dairy	

b)	Poultry	
c)	Piggery	
d)	Mushroom	
e)	Nursery	
f)	Bee keeping	
g)	Any other (specify)	
7.	Any other specify	

VITA

Name of the student : Jobanjit Singh
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University and year of award : Punjab Agricultural University, Ludhiana,
2019
OCPA : 7.88/10.00
Title of Master's Thesis : Opinion of farmers” regarding crop
diversification in Punjab
Awards/Distinction/Scholarship/Fellowship: University Merit Scholarship during M.Sc.