CHAPTER 4

AWARENESS OF FARMERS' REGARDING SUSTAINABLE AGRICULTURE

The farmers' understanding of sustainable agriculture has proven to be efficacious in reducing environmental problems (Blaber et al., 2000; Hoare, 2002). Information is a means of transferring incidents for better awareness to add new dimension that could bring changes in lives, or experiences, awareness and use of information to create knowledge (Low, 2000). The affluence information with regard to agricultural production including cultivation, harvesting, marketing and storage among others may have significant consequences on farmers, implementation of farm tools and the extension services (Oto, 2011).

With the dire need of shifting our agriculture to sustainable agriculture mode, farmers need to keep themselves abreast of awareness regarding the concept of sustainable agriculture and its practices. Farmers are engrossed in feeding the nation and supplying raw materials, to sustain industries. It is, therefore, necessary that farmers are well aware of the issues and development in agriculture to make agriculture sustainable.

AWARENESS OF CONCEPT OF SUSTAINABLE AGRICULTURE:

In order to practise sustainable agriculture awareness of the term is critical. Attempt was made to determine how many respondents were aware of sustainable agriculture. Sustainable agriculture is relatively new term so in order to substantiate our study, respondents were further asked about the various facets of sustainable agriculture.

Table 4.1

Distribution of respondents on the basis of awareness of concept of Sustainable Agriculture

Awareness of concept of sustainable agriculture	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Yes	24 (16.0%)	1 (6.7%)	25 (15.2%)	13 (12.6%)	1 (8.3%)	14 (12.2%)	**39 (13.9%)**
No	126 (84.0%)	14 (93.3%)	140 (84.8%)	90 (87.4%)	11 (91.7%)	101 (87.8%)	**241 (86.1%)**
Total	**150 (53.5%)**	**15 (5.3%)**	**165 (58.9%)**	**103 (36.7%)**	**12 (4.2%)**	**115 (41.1%)**	**280 (100%)**

A cursory look at Table 4.1 reveals that only a little more than one tenth of total respondents, that is, 39 (13.9%) were aware of the concept of sustainable agriculture. Both of the blocks were also found to have almost an equal proportion of respondents having awareness of the sustainable agriculture. Among the villages, Manawala village of Jandiala block was found to have more respondents, that is, 24 (16.0%) having awareness of sustainable agriculture than other villages because many of them were also practicing methods of sustainable agriculture in their farms. Thus, it is observed that very few farmers were aware of the concept of sustainable agriculture. This can be attributed to the low literacy level and lack of dissemination of awareness and knowledge regarding the sustainable agriculture techniques by the government authorities. It was also observed during the study that respondents were not aware of the term sustainable agriculture but they were aware of the organic farming or *"Jaivik kheti"* as locally called, which can be attributed as constituent of sustainable agriculture. Because sustainable agriculture is relatively new concept and term, majority of respondents were found ignorant of the term as such.

Table 4.1.1

Distribution of respondents on the basis of awareness of sustainable agriculture related with their education and size of land holding

	Awareness of sustainable agriculture concept													
	Manawala		Dhirakot		Total		Panj garain wala		Kotli jimmat singh		Total		Total	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Education														
Illiterate	0 (0.0%)	25 (19.8%)	0 (0.0%)	3 (21.4%)	0 (0.0%)	28 (20%)	0 (0.0%)	29 (32.2%)	0 (0.0%)	3 (27.3%)	0 (0.0%)	32 (31.7%)	**0 (0.0%)**	**60 (24.9%)**
Literate	0 (0.0%)	4 (3.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (2.9%)	0 (0.0%)	9 (10%)	0 (0.0%)	1 (9.1%)	0 (0.0%)	10 (9.9%)	**0 (0.0%)**	**14 (5.8%)**
Primary	1 (4.2%)	38 (30.2%)	0 (0.0%)	6 (42.9%)	1 (4%)	44 (31.4%)	0 (0.0%)	25 (27.8%)	1 (100%)	2 (18.2%)	1 (7.1%)	27 (26.7%)	**2 (5.1%)**	**71 (29.5%)**
Secondary	0 (0.0%)	24 (19%)	0 (0.0%)	4 (28.6%)	0 (0.0%)	28 (20%)	1 (7.7%)	16 (17.8%)	0 (0.0%)	1 (9.1%)	1 (7.1%)	17 (16.8%)	**1 (2.6%)**	**45 (18.7%)**
Higher Secondary	1 (4.2%)	21 (16.7%)	1 (100%)	0 (0.0%)	2 (8%)	21 (15%)	0 (0.0%)	5 (5.6%)	0 (0.0%)	1 (9.1%)	0 (0.0%)	6 (5.9%)	**2 (5.1**	**27 (11.2%)**
Graduation	19 (79.2%)	12 (9.5%)	0 (0.0%)	1 (7.1%)	19 (76%)	13 (9.3%)	11 (84.6%)	6 (6.7%)	0 (0.0%)	3 (27.3%)	11 (78.6%)	9 (8.9%)	**30 (76.9%)**	**22 (9.1%)**
Any other*	3 (12.5%)	2 (1.6%)	0 (0.0%)	0 (0.0%)	3 (12%)	2 (1.4%)	1 (7.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (7.1%)	0 (0.0%)	**4 (10.3%)**	**2 (0.8%)**
Total	**24 (16.0%)**	**126 (84.0%)**	**1 (6.7%)**	**14 (93.3%)**	**25 (15.2%)**	**140 (84.8%)**	**13 (12.6%)**	**90 (87.4%)**	**1 (8.3%)**	**11 (91.7%)**	**14 (12.2%)**	**101 (87.8%)**	**39 (13.9%)**	**241 (86.1%)**
Size of land holding														
Marginal (<1 hectare)	1 (4.2%)	3 (2.4%)	0 (0.0%)	0 (0.0%)	1 (4%)	3 (2.1%)	2 (15.4%)	4 (4.4%)	0 (0.0%)	3 (27.3%)	2 (14.3%)	7 (6.9%)	**3 (7.7%)**	**10 (4.1%)**
Small (1-2 hectares)	1 (4.2%)	7 (5.6%)	0 (0.0%)	3 (21.4%)	1 (4%)	10 (7.1%)	1 (7.7%)	6 (6.7%)	0 (0.0%)	0 (0.0%)	1 (7.1%)	6 (5.9%)	**2 (5.1%)**	**16 (6.6%)**
Semi-medium (2-4 hectares)	6 (25%)	32 (25.4%)	0 (0.0%)	1 (7.1%)	6 (24%)	33 (23.6%)	2 (15.4%)	18 (20%)	0 (0.0%)	3 (27.3%)	2 (14.3%)	21 (20.8%)	**8 (20.5%)**	**54 (22.4%)**
Medium (4-10 hectares)	7 (29.2%)	52 (41.3%)	1 (100%)	6 (42.9%)	8 (32%)	58 (41.4%)	2 (15.4%)	40 (44.4%)	0 (0.0%)	4 (36.4%)	2 (14.3%)	44 (43.6%)	**10 (25.6%)**	**102 (42.3%)**
Large (10> hectares)	9 (37.5%)	32 (25.4%)	0 (0.0%)	4 (28.6%)	9 (39%)	36 (25.7%)	6 (46.2%)	22 (24.4%)	1 (100%)	1 (9.1%)	7 (50%)	23 (22.8%)	**16 (41%)**	**59 (24.5%)**
Total	**24 (16.0%)**	**126 (84.0%)**	**1 (6.7%)**	**14 (93.3%)**	**25 (15.2%)**	**140 (84.8%)**	**13 (12.6%)**	**90 (87.4%)**	**1 (8.3%)**	**11 (91.7%)**	**14 (12.2%)**	**101 (87.8%)**	**39 (13.9%)**	**241 (86.1%)**

Table 4.1.1 presents that higher proportion of respondents who were having knowledge of sustainable agriculture were graduates, that is, 30 (76.9%) followed by 4 (10.3%) respondents having other qualifications such as holding diploma degrees or other professional courses. On the other hand, among those who did not have any knowledge about sustainable agriculture (out of 241), a higher proportion of respondents, that is, 71 (29.5%) were educated upto primary level, followed by 60 (24.9%) respondents who were illiterates. Both the blocks show consonance in terms of educational level of respondents having knowledge of sustainable agriculture. It shows that education does play a part in creating awareness and increasing the knowledge. Majority of respondents in both the blocks having knowledge of sustainable agriculture were graduates, that is, 19 (76 %) in Jandiala block and 11 (78.6%) in Ajnala block. Further, it can be observed that higher proportion of respondents having knowledge of sustainable agriculture, that is, 16 (41 %) were large size land holding farmers, followed by 10 (25.6%) respondents who were medium size land holding farmers. This may be because bigger farmers had better access to knowledge and were well aware of the latest updates of agriculture.

Table 4.1.2

Distribution of respondents on the basis of awareness regarding various aspects of sustainable agriculture

Awareness regarding various aspects of sustainable agriculture*	**Jandiala block**			**Ajnala block**			**Total**
	Manawala	**Dhirakot**	**Total**	**Panj garain wala**	**Kotli jimmat singh**	**Total**	
Controls, protects and renews soil fertility and the natural resources	11 (45.8%)	0 (0.0%)	11 (44.0%)	8 (61.5%)	1 (100.0%)	9 (64.3%)	**20 (51.3%)**
Reduces the use of non-renewable resources and purchased (external or off-farm) production inputs	6 (25.0%)	1 (100.0%)	7 (28.0%)	3 (23.1%)	0 (0.0%)	3 (21.4%)	**10 (25.6%)**
Minimizes adverse impacts on health, wildlife, water quality and the environment	6 (25.0%)	0 (0.0%)	6 (24.0%)	4 (30.8%)	0 (0.0%)	4 (28.6%)	**10 (25.6%)**
Promotes opportunity in family farming and farm communities,	4 (16.7%)	0 (0.0%)	4 (16.0%)	4 (30.8%)	1 (100.0%)	5 (35.7%)	**9 (23.1%)**
Achieves the integration of natural biological cycles	5 (20.8%)	0 (0.0%)	5 (20.0%)	2 (15.4%)	0 (0.0%)	2 (14.3%)	**7 (17.9%)**
Optimizes the management and use of on- farm inputs	3 (12.5%)	1 (100.0%)	4 (16.0%)	2 (15.4%)	0 (0.0%)	2 (14.3%)	**6 (15.4%)**
Provides on adequate and dependable farm income	4 (16.7%)	0 (0.0%)	4 (16.0%)	1 (7.7%)	0 (0.0%)	1 (7.1%)	**5 (12.8%)**

*****Multiple response table

Respondents who were observed having knowledge of sustainable agriculture were further asked about the various aspects of sustainable agriculture and their responses were noted. Table 4.1.2 represents the responses of the respondents regarding the means of sustainable agriculture. Out of total 280 respondents, only 39 respondents were found to have knowledge of sustainable agriculture. It is worth noticing that, only one respondent from Kotli jimmat singh of Ajnala block and Dhirakot village of Jandiala was found having awareness of sustainable agriculture. Data reveal that a higher proportion of respondents, 20 (51.3%) out of 39 respondents, believed that sustainable agriculture controls, protects and renews soil fertility, followed by, 10 (25.6%) respondents each who mentioned that it reduces the use of non-renewable resources and purchased (external or off-farm) production inputs and that it minimizes adverse impacts on health, safety, wildlife, water quality and the environment. As many as 9 (23.1%) respondents believed that sustainable agriculture promotes opportunity in family farming and farm communities. Further, 7 (17.9%) respondents said sustainable agriculture achieves the integration of natural biological cycles, 6 (15.4%) respondents said it optimized the management and use of on- farm inputs and lastly 5 (12.8%) respondents said sustainable agriculture helped in providing adequate and dependable farm income Farmers of this area regard sustainable agriculture related to organic farming and their understanding of sustainable agriculture is limited to the concept of organic farming and its postulates, primarily because sustainable agriculture is a relatively new term than organic farming and farmers are more familiar with the term organic farming. Moreover, awareness regarding sustainability in agriculture is also not profound in this region. Data from the table reveal that a small proportion of respondents had awareness of sustainable agriculture. A wide difference was observed between the villages regarding the concepts of sustainable agriculture. Difference of awareness level could be attributed to lower level of awareness among the respondents. Inadequate measures adopted by the government authorities to educate the farmers in this area and the laxity on the part of respondents also played the significant effect on the awareness level of respondents.

PRACTICES OF SUSTAINABLE AGRICULTURE:

Sustainable farming practices implies an ecological production management system that encourages and invigorate ecosystems, biodiversity, geological cycles and

social-economic conditions of the farmers. It refers to minimal use of off-farm inputs and management practices that rejuvenate and boost ecological harmony (Vandermeer et al., 1998; Xu et al., 2000; Greene and Kremen, 2003). Sustainability in agriculture comprehends concepts of both resilience which denotes, the capacity to persevere shocks and stresses, and persistence which means, the capacity to persist over long periods. (Pretty, 2007; Bradford and Wichner, 2009). Keeping in view the deteriorating conditions of agriculture globally, there is requirement of sustainable agriculture practices that do not produce any harmful effects on the environment, within the reach of farmers and can result into augmenting the food productivity levels.

Farming is blend of diverse components culminating in the development and maintenance of agriculture. In order to create the grounds of sustainable agriculture these components should work in an integrated manner. Sustainable agriculture practices involve enhancing and bringing together these components which includes, good practices of soil, water management, crop protection, promoting bio-diversity and socio-economic welfare activities people involved in agriculture.

A. Crop Rotation: Crop rotation can be defined as sequence of growing different crops and cover crops in the same field. While scheduling the crop rotation factors such as crop family, depth of plant roots and nutrient needs of crops are taken into account (Union of Concerned Scientists, 2017). Some Examples of crop rotations are: Cotton – Jowar Cotton – Jowar – groundnut Cotton – Bajri Cotton- wheat or Rabi Jowar or gram Jowar mixed with pulse Sugarcane – cotton Sugarcane – Rabi Jowar Rice - wheat- rice Wheat- maize – sugarcane. Advantages of crop rotation includes:

(1) Increase in crop productivity,

(2) Reduces the risk of pest attack, as pests have tendency to foster over same crop and cultivating same crop provides habitat to such pests. Crop rotation breaks the pest reproduction cycle.

(3) Diversify the crops grown and mitigate the risk of crop loss and financial loss of not getting remunerative prices of crops (NIOS, 2012).

B. Mixed cropping: Mixed cropping also named as inter-cropping is a type of agriculture practice that involves cultivating two or more crops simultaneously in the same field with distinct row arrangements. For instance, cereal crop is

mixed with legumes such as "jowar" with "tur". Benefits of mixed cropping includes (1) optimum utilization of space and nutrients in the soil. (2) averse the risk crop diseases, pest and adverse weather conditions. (3) augmenting the source of income. The cereal crops are usually mixed with legumes e.g. "Jowar" or "Bajra" mixed with "Tur", "Udad", "Mung". Wheat is mixed with peas, gram or mustard. Cotton is mixed with "Tur" or "Jowar" (NIOS, 2012).

C. **Beneficial Insects and Biological Pest Control**: Biocontrol agents are organisms or plants that help in controlling unwanted and harmful insects, weeds and mites etc. from the field and help in conservation of agriculture. They are introduced in farming as predators, pathogens and parasites etc. (TNAU, 2017). Benefits of biocontrol agents are:

(1) Biocontrol agents are economical than opting other methods of pest control.

(2) They are non-toxic and does not produce any harmful effect on environment and person applying them.

(3) They grow easily in soil and do not leave any residue after application.

(4) Biocontrol agents apart from keeping diseases at bay also improves growth of roots and plant through encouraging beneficial soil flora (Sharma et.al, 2013).

D. **Rotational grazing:** Rotational grazing is maintaining periodic shift of the grazing land for livestock. It serves many purposes in farming. Soil receive nutrients from the grazing as the excreta of the animals provide natural fertilizer for soil and help in replenishing the nutrients. Apart from that, it helps in getting rid of the weeds and other harmful pest that attack the crops by changing the location. Shifting the land also check the soil erosion as it prevents trampling. (Rinkesh, 2017)

E. **Better Water Management:** Water is elixir for agriculture. It sustains life of crops and flora present in the soil. In areas where rainfall is not adequate, these require other water resources for irrigation. Water management techniques refers to practices of optimum utilization of water resources available and maintaining them. When water is utilised in more than the capacity, it is being naturally replenished, it tends to become non-renewable source. Some of the methods of water management can be listed as follows:

(1) Reducing leakage of water while conveying.

(2) Using sprinkler and drip irrigation in dry areas lacking water.

(3) Replenishing ground water during rainy season.

(4) Adopting on-farm water management techniques. For instance, effective designing of irrigation methods, levelling and shaping of land effectively (HAU, 2010). Water management also includes selection of suitable crops which adapt to local weather conditions. Choosing water intensive crops in dry areas can lead to ground water depletion, soil degradation and salinization. Rainwater can be harvested and stored to utilise in case of drought conditions (Rinkesh, 2017).

F. **Soil Enrichment:** Soil is building block of farming. Healthy soil translates into healthy crop and prosperous farmer. Good soil set grounds for robust crop which is less susceptible to pest and leads to improved yield. Whereas, poor condition of soil need to harness with fertilizers in order to acquire higher yield. Soil enrichment is the technique followed to rejuvenate soil so that nutrients of soil are improved and maintained. Soil can be enriched in many ways such as: applying fertilizers (organic or chemical) leaving crop residue in the field after the harvest etc.

G. Integrated Pest Management (IPM): IPM is pest management strategies comprising farmer based management system that encourages natural control of pest population. IPM is combination of pest management techniques for identifying and observing the behaviour of pest in early stage, as every pest does not cause harm and their co-existence with crops may not necessarily hurt farming. IPM relies on biological rather than chemical measures to great extent. Chemical pesticides ae used only as last resort (TNAU, 2017). Methods involved in IPM include:

(1) Agronomic methods: crop rotation, soil tillage, judicious application of fertilizers, varying the time of planting and harvesting of crops.

(2) Mechanical methods: using hand for destruction of pest, exclusion by barriers.

(3) Biological control: encouraging natural enemies, introduction of predators and specific parasites.

(4) Physical methods: application of hot water treatment, exposing grain to sunlight, reducing moisture content of grain by drying and heating godown before storing grains. (NIPHM, 2017)

H. Recycling crop residue: Residue of crops such as rice, wheat, cotton etc. can be added to soil. Crop residue are integral part of nutrient cycling and can be very effective in maintaining physical, biological and chemical structure of soil. Otherwise crop residues are burnt after harvesting, using crop residue can play major role in keeping environment clean and pollution free. Advantages of using crop residue are as follows:

(1) Favour the creation of soil aggregates as soil is less disturbed and aids agglomeration of soil.

(2) Increase the soil porosity and water retention.

(3) Maintain temperature of soil in winters as it reduces upward heat flux from soil and during summers reduces temperature because of shade effect.

(4) Maintain moisture content of soil by mitigating evaporation.

(5) Increase soil Ph level and carbon content in the soil.

(6) Reduce greenhouse gas emissions as it acts as carbon sequestration, that is, trapping carbon in the soil (HAU, 2010)

I. **Agro forestry:** Trees are quintessential essence of ecosystem and provides multiple sources and products to human race. Trees regulate the temperature in atmosphere. There are wide range of trees that serves numerous functions in farms. Among these are trees for fertilizers aiding land rejuvenation and maintaining soil health, fodder trees for timber and energy, some trees are of medicinal properties while many miscellaneous products viz. gum, resin or latex products are also acquired from trees (Tiwari, 2008). Integrated and holistic development of rainfed areas demand agro-forestry, that is, combining trees (perennial crops) with food crops (annual crops) in accordance with economic and ecological conditions of the area. Agro-forestry empowers and equips the farmer with many advantages including maintaining and increasing the productivity of soil, diversifying the income gains, tackling labour issues, increasing negotiating power of the farmers in market situation. (TNAU, 2014)

J. Natural / organic manure: Manure provide possibly all nutrients required by soil though in limited quantity. Natural manure maintain carbon and nitrogen ratio in the soil, improves fertility of the soil, enhances physical and chemical properties of soil. In addition to improving structure and texture of soil, they

help in water retention of soil. Manure are organic content obtained from human, animals and plant residue containing plant nutrients in complex forms., that is, manure is organically derived from animal and plant waste that are substitutes of plant nutrients. On decomposition, these manure release nutrients and improve crop productivity (TNAU, 2016).

Keeping in mind these agricultural practices, the respondents were asked whether they were using any of the sustainable agricultural practices.

Table 4.2

Distribution of respondents on the basis of practices of sustainable agriculture

Practicing Sustainable agriculture	**Jandiala block**			**Ajnala block**			**Total**
	Manawala	**Dhirakot**	**Total**	**Panj garain wala**	**Kotli jimmat singh**	**Total**	
Yes	41 (27.3%)	6 (40.0%)	47 (28.5%)	12 (11.7%)	3 (25.0%)	15 (13.0%)	**62 (22.1%)**
No	109 (72.7%)	9 (60.0%)	118 (71.5%)	91 (88.3%)	9 (75.0%)	100 (87.0%)	**218 (77.9%)**
Total	**150 (53.5%)**	**15 (5.3%)**	**165 (58.9%)**	**103 (36.7%)**	**12 (4.2%)**	**115 (41.1%)**	**280 (100%)**

Table 4.2 enumerates the respondents who were practicing sustainable agricultural practices. It is observed from the table that the majority of respondents, that is, 218 (77.9%) were not practicing any of the sustainable agricultural practices. However, as many as 62 (22.1%) respondents were found to be practicing sustainable agriculture in their farm. Among the blocks a higher proportion of respondents from Jandiala block, that is, 47 (28.5%) were practicing sustainable agriculture in comparison to 15 (13.0%) respondents of Ajnala block. The table highlights that sustainable agriculture practices were more followed in Jandiala block than in Ajnala block. The probable reason of not adopting such practices could be lack of interest, lack of resources to opt such practices, high perceived risk involved and uncertainty of return, lack of sufficient assistance from the government to adopt such practices and non-availability of labour.

Table 4.2.1

Distribution of respondents on the basis of practicing sustainable agriculture related with their education, size of land holding and income

	Practicing sustainable agriculture													
	Manawala		Dhirakot		Total		Panj garain wala		Kotli jimmat singh		Total		Total	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Education														
Illiterate	5 (12.2%)	20 (18.3%)	2 (33.3%)	1 (11.1%)	7 (14.9%)	21 (17.8%)	0 (0.0%)	29 (31.9%)	0 (0.0%)	3 (33.3%)	0 (0.0%)	32 (32%)	**7 (11.3%)**	**53 (24.3%)**
Literate	0 (0.0%)	4 (3.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (3.4%)	0 (0.0%)	9 (9.9%)	0 (0.0%)	1 (11.1%)	0 (0.0%)	10 (10%)	**0 (0.0%)**	**14 (6.4%)**
Primary	6 (14.6%)	33 (30.3%)	2 (33.3%)	4 (44.4%)	8 (17%)	37 (31.4%)	2 (16.7%)	23 (25.3%)	1 (33.3%)	2 (22.2%)	3 (20%)	25 (25%)	**11 (17.7%)**	**62 (28.4%)**
Secondary	9 (22%)	15 (13.8%)	2 (33.3%)	2 (22.2%)	11 (23.4%)	17 (14.4%)	3 (25%)	14 (15.4%)	1 (33.3%)	0 (0.0%)	4 (26.7%)	14 (14%)	**15 (24.2%)**	**31 (14.2%)**
Higher Secondary	5 (12.2%)	17 (15.6%)	0 (0.0%)	1 (11.1%)	5 (10.6%)	18 (15.3%)	0 (0.0%)	5 (5.5%)	0 (0.0%)	1 (11.1%)	0 (0.0%)	6 (6%)	**5 (8.1%)**	**24 (11%)**
Graduation	14 (34.1%)	17 (15.6%)	0 (0.0%)	1 (11.1%)	14 (29.8%)	18 (15.3%)	6 (50%)	11 (12.1%)	1 (33.3%)	2 (22.2%)	7 (46.7%)	13 (13%)	**21 (33.9%)**	**31 (14.2%)**
Any other*	2 (4.9%)	3 (2.8%)	0 (0.0%)	0 (0.0%)	2 (4.3%)	3 (2.5%)	1 (8.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (6.7%)	0 (0.0%)	**3 (4.8%)**	**3 (1.4%)**
Total	**41 (27.3%)**	**109 (72.7%)**	**6 (40.0%)**	**9 (60.0%)**	**47 (28.5%)**	**118 (71.5%)**	**12 (11.7%)**	**91 (88.3%)**	**3 (25.0%)**	**9 (75.0%)**	**15 (13.0%)**	**100 (87.0%)**	**62 (22.1%)**	**218 (77.9%)**
Size of land holding														
Marginal (<1 hectare)	0 (0.0%)	4 (3.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (3.4%)	2 (16.7%)	4 (4.4%)	0 (0.0%)	3 (33.3%)	2 (13.3%)	7 (7%)	**2 (3.2%)**	**11 (5%)**
Small (1-2 hectares)	4 (9.8%)	4 (3.7%)	0 (0.0%)	33 (3.3%)	4 (8.5%)	7 (5.9%)	1 (8.3%)	6 (6.6%)	0 (0.0%)	0 (0.0%)	1 (6.7%)	6 (6%)	**5 (8.1%)**	**13 (6%)**
Semi-medium (2-4 hectares)	13 (31.7%)	25 (22.9%)	1 (16.7%)	0 (0.0%)	14 (29.8%)	25 (21.2%)	0 (0.0%)	20 (22%)	0 (0.0%)	3 (33.3%)	0 (0.0%)	23 (23%)	**14 (22.6%)**	**48 (22%)**
Medium (4-10 hectares)	16 (39%)	43 (39.4%)	3 (50%)	4 (44.4%)	19 (40.4%)	47 (39.8%)	5 (41.7%)	37 (40.7%)	2 (66.7%)	2 (22.2%)	7 (46.7%)	39 (39%)	**26 (41.9%)**	**86 (39.4%)**
Large (10> hectares)	8 (19.5%)	33 (30.3%)	2 (33.3%)	2 (22.2%)	10 (21.3%)	35 (29.7%)	4 (33.3%)	24 (26.4%)	1 (33.3%)	1 (11.1%)	5 (33.3%)	25 (25%)	**15 (24.2%)**	**60 (27.5%)**
Total	**41 (27.3%)**	**109 (72.7%)**	**6 (40.0%)**	**9 (60.0%)**	**47 (28.5%)**	**118 (71.5%)**	**12 (11.7%)**	**91 (88.3%)**	**3 (25.0%)**	**9 (75.0%)**	**15 (13.0%)**	**100 (87.0%)**	**62 (22.1%)**	**218 (77.9%)**
Income (in Rupees)														
Upto 1 lakh	2 (4.9%)	2 (1.8%)	0 (0.0%)	0 (0.0%)	2 (4.3%)	2.0 (1.7%)	2 (16.7%)	6 (6.6%)	0 (0.0%)	3 (33.3%)	2 (13.3%)	9 (9%)	**4 (6.5%)**	**11 (5%)**
1-2 lakhs	3 (7.3%)	11 (10.1%)	1 (16.7%)	0 (0.0%)	4 (8.5%)	11.0 (9.3%)	0 (0.0%)	14 (15.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	14 (14%)	**4 (6.5%)**	**25 (11.5%)**
2-3 lakhs	5 (12.2%)	8 (7.3%)	3 (50.0%)	3 (33.3%)	8 (17.0%)	11.0 (9.3%)	1 (8.3%)	19 (20.9%)	0 (0.0%)	3 (33.3%)	1 (6.7%)	22 (22%)	**9 (14.5%)**	**33 (15.1%)**
3-4 lakhs	6 (14.6%)	19 (17.4%)	1 (16.7%)	3 (33.3%)	7 (14.9%)	22.0 (18.6%)	3 (25.0%)	15 (16.5%)	3 (100%)	2 (22.2%)	6 (40.0%)	17 (17%)	**13 (21%)**	**39 (17.9%)**
4-5 lakhs	6 (14.6%)	18 (16.5%)	0 (0.0%)	3 (33.3%)	6 (12.8%)	21.0 (17.8%)	3 (25.0%)	17 (18.7%)	0 (0.0%)	1 (11.1%)	3 (20.0%)	18 (18%)	**9 (14.5%)**	**39 (17.9%)**
More than 5 lakhs	19 (46.3%)	51 (46.8%)	1 (16.7%)	0 (0.0%)	20 (42.6%)	51.0 (43.2%)	3 (25.0%)	20 (22.0%)	0 (0.0%)	0 (0.0%)	3 (20.0%)	20 (20%)	**23 (37.1%)**	**71 (32.6%)**
Grand Total	**41 (27.3%)**	**109 (72.7%)**	**6 (40.0%)**	**9 (60.0%)**	**47 (28.5%)**	**118 (71.5%)**	**12 (11.7%)**	**91 (88.3%)**	**3 (25.0%)**	**9 (75.0%)**	**15 (13.0%)**	**100 (87.0%)**	**62 (22.1%)**	**218 (77.9%)**

Table 4.2.1 presents the number of respondents who were practicing sustainable agriculture with respect to education qualification, farm size holdings and annual income. Data indicates that out of 62, higher proportion of respondents that is, 21 (33.9%) who were practicing sustainable agriculture were graduates followed by 15 (24.2%) who were educated upto secondary level. It was found that among those who were not practicing sustainable agriculture (218), higher proportion 62 (28.4%) was of respondents who were educated upto primary level. It can be observed that in both the blocks higher proportion of respondents who were practicing sustainable agriculture were graduates, that is, 7 (46.7%) in Ajnala block and 14 (29.8%) in Jandiala block. It can be said that education can act as driving force in adopting sustainable agriculture. Further, higher proportion of respondents practicing sustainable agriculture were having medium scale land holdings, that is, 26 (41.9%) followed by 15 (24.2%) respondents having large size land holdings. lastly, in terms of annual income, it was observed that higher proportion of respondents 23 (37.1%) who were practicing sustainable agriculture were having annual income of more than Rupees 5 lakhs followed by, 13 (21%) respondents having annual income of Rupees 3-4 lakhs. In Jandiala block higher proportion of respondents who were practicing sustainable agriculture were having annual income of more than Rupees 5 lakhs 20 (42.6%), followed by 8 (17%) having annual income of Rupees 2-3 lakhs. Whereas, in Ajnala block higher proportion of respondents, that is, 6 (40%) were having annual income of Rupees 3-4 lakhs followed by 3 (23.1%) respondents each having Rupees 4-5 lakhs and more than Rupees 5 lakhs income. This shows that most of the respondents having higher income were using sustainable agriculture methods as they were able to afford them.

Those who answered in the affirmative regarding practising sustainable agriculture were further asked what kind of practices of sustainable agriculture they had adopted.

Table 4.2.2

Distribution of respondents on the basis of adopted practices of sustainable agriculture

Sustainable agriculture practices adopted*	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Use of natural manure	31 (75.6%)	4 (66.7%)	35 (74.5%)	8 (66.7%)	0 (0.0%)	8 (53.3%)	**43 (69.4%)**
Recycling crop waste	27 (65.9%)	4 (66.7%)	31 (66.0%)	7 (58.3%)	2 (66.7%)	9 (60.0%)	**40 (64.5%)**
Mixed cropping	17 (41.5%)	5 (83.3%)	22 (46.8%)	4 (33.3%)	1 (33.3%)	5 (33.3%)	**27 (43.5%)**
Crop rotation	11 (26.8%)	1 (16.7%)	12 (25.5%)	3 (25.0%)	0 (0.0%)	3 (20.0%)	**15 (24.2%)**
Soil enrichment	8 (19.5%)	2 (33.3%)	10 (21.3%)	4 (33.3%)	0 (0.0%)	4 (26.7%)	**14 (22.6%)**
Water conservation	4 (9.8%)	0 (0.0%)	4 (8.5%)	1 (8.3%)	0 (0.0%)	1 (6.7%)	**5 (8.1%)**
Rotational grazing	4 (9.8%)	0 (0.0%)	4 (8.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**4 (6.5%)**
Use of natural pest predators	2 (4.9%)	0 (0.0%)	2 (4.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**2 (3.2%)**
Agro forestry	1 (2.4%)	0 (0.0%)	1 (2.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**1 (1.6%)**
Using Integrated pest management techniques	1 (2.4%)	0 (0.0%)	1 (2.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**1 (1.6%)**

*Multiple response table

The 62 respondents who were found practicing sustainable agricultural practices, were asked about the agricultural practices that they followed in their land, Table 4.2.2 demonstrates the agricultural practices adopted by the respondents. Data reveal that higher proportion, 43(69.4%) respondents have used natural manure in their farm which is called “Rudhi”, followed by 40(64.5%) percent farmers recycle their crop waste or residue called as Tudhi. As many as 27(43.5%) respondents were observed practicing mixed cropping such as wheat-mustard and wheat-barley in their farm. Further 15(24.2%) respondents practised crop rotation. A small proportion of respondents were practising other agriculture techniques in their farm. As many as 14

(22.6) enriched their soil with organic fertilizers, little proportion of 5(8.1%) respondents opted water conservation techniques for irrigation such as sprinklers and drip irrigation There were a higher proportion of respondents from Jandiala block that is 35(74.5%) and 4(8.5%) who practiced application of natural manure and water conservation techniques respectively in comparison to Ajnala block which accounts to only 8 (53.3%) and 1 (6.7%). There was a higher proportion of respondents, 4(26.7%) from Ajnala block practicing soil enrichment than in Jandiala block, 10 (21.3%). Table reveals that Manawala village of Jandiala block had higher proportion of respondents practicing techniques such as using natural manure, water conservation, rotational grazing and using integrated pest management techniques. Dhirakot village of Jandiala block was observed having a higher proportion of respondents practicing crop rotation and recycling crop waste. Panj garain wala village of Ajnala block had a higher proportion of respondents practicing soil enrichment.

Table 4.2.3

Distribution of respondents on the basis of practicing sustainable agriculture related with awareness regarding environmental conditions

Practicing sustainable agriculture and awareness regarding environmental condition										
	Manawala N=41		**Dhirakot N=6**		**Panj garain wala N=12**		**Kotli jimmat singh N=3**		**Total N=62**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Change in climate	41 (100%)	0 (0.0%)	6 (100%)	0 (0.0%)	10 (83.3%)	2 (16.7%)	3 (100%)	0 (0.0%)	**60 (96.8%)**	**2 (3.2%)**
Change in yield	41 (100%)	0 (0.0%)	5 (83.3%)	1 (16.7%)	11 (91.7%)	1 (8.3%)	3 (100%)	0 (0.0%)	**60 (96.8%)**	**2 (3.2%)**
Yield increased	14 (34.1%)	0 (0.0%)	1 (16.7%)	0 (0.0%)	5 (41.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**20 (32.2%)**	**0 (0.0%)**
Yield decreased	27 (65.9%)	0 (0.0%)	4 (66.7%)	0 (0.0%)	6 (50%)	0 (0.0%)	3 (100%)	0 (0.0%)	**40 (64.5%)**	**0 (0.0%)**
No change	0 (0.0%)	0 (0.0%)	1 (16.7%)	0 (0.0%)	1 (8.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**2 (3.2%)**	**0 (0.0%)**

Table 4.2.3 represents the relation between changes observed in environment by the respondent with the number of respondents practicing sustainable agriculture.

Data indicates that among those who observed change in climate majority of respondents 60 (96.8%) were practicing sustainable agriculture. Results of chi-square shows that, χ^2 =1.35, df=1, *p*-value at 0.05 (level of significance =3.84) shows that there is no significant association between change in climate observed by the respondents and practising sustainable agriculture. Similarly, majority of respondents that is, 60 (96.8%) were observing change in yield and also practicing sustainable agriculture. Results of chi-square shows that, χ^2 =3.47, df=1, *p*-value at 0.05 (level of significance =3.84) shows that there is no significant association between change in yield observed by the respondents and practising sustainable agriculture. Among those who have observed change in yield and practicing sustainable agriculture, higher proportion of respondents, that is, 40 (64.5%) mentioned yield has decreased and 20 (32.2%) respondents said yield has increased. Data highlights that those respondents who have observed change in climate and yield and observed decreasing trend in yield are in higher proportion who were practising sustainable agriculture. Probably, perceived change in climate and decreased yield have had inspired them to adopt sustainable agriculture practices. Results of chi-square shows that, χ^2 =10.08, df=2, *p*-value at 0.05 (level of significance =5.99) shows that there is a significant association between changes in yield observed by the respondents and practising sustainable agriculture. This lends support to the hypothesis that awareness of farmers regarding environmental conditions is likely to have positive influence on the agricultural practices adopted by them.

SOIL ENRICHMENT AND METHODS ADOPTED:

Soil is the foundation on which farming rest its existence and therefore it is of grave importance to initiate the process to enrich the soil content obliging the development of agriculture. There are number of methods to enrich the soil nutrients including applying chemical fertilizers and natural fertilizers. Respondents were inquired about methods they adopt for soil enrichment in order to appraise the soil condition.

Table 4.3

Distribution of respondents on the basis of methods adopted for soil enrichment

Methods of soil enrichment	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Use of chemical fertilisers	60 (40.0%)	13 (86.7%)	73 (44.2%)	69 (67.0%)	8 (66.7%)	77 (67.0%)	**150 (53.6%)**
Chemical fertilizers and natural manure	48 (32.0%)	1 (6.7%)	49 (29.7%)	18 (17.5%)	0 (0.0%)	18 (15.7%)	**67 (23.9%)**
Use of natural manure	15 (10.0%)	0 (0.0%)	15 (9.1%)	3 (2.9%)	0 (0.0%)	3 (2.6%)	**18 (6.4%)**
Natural manure and crop rotation	15 (10.0%)	0 (0.0%)	15 (9.1%)	2 (1.9%)	0 (0.0%)	2 (1.7%)	**17 (6.1%)**
Practising crop rotation	3 (2.0%)	0 (0.0%)	3 (1.8%)	5 (4.9%)	0 (0.0%)	5 (4.3%)	**8 (2.9%)**
Fertilizers and crop rotation	2 (1.3%)	0 (0.0%)	2 (1.2%)	2 (1.9%)	0 (0.0%)	2 (1.7%)	**4 (1.4%)**
Not adopted any method	7 (4.7%)	1 (6.7%)	8 (4.8%)	4 (3.9%)	4 (33.3%)	8 (7.0%)	**16 (5.7%)**
Total	**150 (53.5%)**	**15 (5.3%)**	**165 (58.9%)**	**103 (36.7%)**	**12 (4.2%)**	**115 (41.1%)**	**280 (100%)**

Table 4.3 reveals method of soil enrichment adopted by the farmers. It can be observed that more than half of the respondents, 150(53.6%) use chemical fertilisers for soil enrichment, followed by 67 (23.9) % adopting chemical fertilisers and natural manure method of soil enrichment together. As many as 18(6.4%) respondents were using natural manure in their farm for enriching the nutrients in their soil. A very small proportion 8 (2.9%) respondents were practicing crop rotation. Among blocks, use of chemical fertilisers was more prominent in Ajnala block which is 77(67.0%) as compared to Jandiala block which is 73(44.2%) respondents respectively. Respondents of Jandiala block were observed adopting combination of both natural manure and chemical fertilisers which accounts to 49(29.7%) which is in higher proportion in comparison to 18(15.7%) respondents of Ajnala block. This shows that respondents in Jandiala block were more aware regarding the uses of natural manure as compared to those in Ajnala block.

Table 4.3.1

Distribution of respondents on the basis of adoption of soil preservation related with their education and size of land holding

	Adopting soil preservation													
	Manawala		Dhirakot		Total		Panj garain wala		Kotli jimmat singh		Total		Total	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Education														
Illiterate	24 (16.8%)	1 (14.3%)	3 (21.4%)	0 (0.0%)	27 (17.2%)	1 (12.5%)	29 (29.3%)	0 (0.0%)	2 (25.0%)	1 (25.0%)	31 (29.0%)	1 (12.5%)	**58 (22.0%)**	**2 (12.5%)**
Literate	4 (2.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (2.5%)	0 (0.0%)	9 (9.1%)	0 (0.0%)	1 (12.5%)	0 (0.0%)	10 (9.3%)	0 (0.0%)	**14 (5.3%)**	**0 (0.0%)**
Primary	38 (26.6%)	1 (14.3%)	6 (42.9%)	0 (0.0%)	44 (28.0%)	1 (12.5%)	24 (24.2%)	1 (25.0%)	1 (12.5%)	2 (50.0%)	25 (23.4%)	3 (37.5%)	**69 (26.1%)**	**4 (25.0%)**
Secondary	24 (16.8%)	0 (0.0%)	3 (21.4%)	1 (100%)	27 (17.2%)	1 (12.5%)	17 (17.2%)	0 (0.0%)	1 (12.5%)	0 (0.0%)	18 (16.8%)	0 (0.0%)	**45 (17.0%)**	**1 (6.3%)**
Higher Secondary	22 (15.4%)	0 (0.0%)	1 (7.1%)	0 (0.0%)	23 (14.6%)	0 (0.0%)	5 (5.1%)	0 (0.0%)	1 (12.5%)	0 (0.0%)	6 (5.6%)	0 (0.0%)	**29 (11.0%)**	**0 (0.0%)**
Graduation	28 (19.6%)	3 (42.9%)	1 (7.1%)	0 (0.0%)	29 (18.5%)	3 (37.5%)	14 (14.1%)	3 (75.0%)	2 (25.0%)	1 (25.0%)	16 (15.0%)	4 (50.0%)	**45 (17.0%)**	**7 (43.8%)**
Any other*	3 (2.1%)	2 (28.6%)	0 (0.0%)	0 (0.0%)	3 (1.9%)	2 (25.0%)	1 (1.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.9%)	0 (0.0%)	**4 (1.5%)**	**2 (12.5%)**
Total	**143 (95.3%)**	**7 (4.7%)**	**14 (93.3%)**	**1 (6.7%)**	**157 (95.2%)**	**8 (4.8%)**	**99 (96.1%)**	**4 (3.9%)**	**8 (66.7%)**	**4 (33.3%)**	**107 (93.0%)**	**8 (7.0%)**	**264 (94.3%)**	**16 (5.7%)**
Size of land holding														
Marginal (<1 hectare)	4 (2.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (2.5%)	0 (0.0%)	6 (6.1%)	0 (0.0%)	2 (25.0%)	1 (25.0%)	8 (7.5%)	1 (12.5%)	**12 (4.5%)**	**1 (6.3%)**
Small (1-2 hectares)	8 (5.6%)	0 (0.0%)	3 (21.4%)	0 (0.0%)	11 (7.0%)	0 (0.0%)	7 (7.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (6.5%)	0 (0.0%)	**18 (6.8%)**	**0 (0.0%)**
Semi-medium (2-4 hectares)	37 (25.9%)	1 (14.3%)	1 (7.1%)	0 (0.0%)	38 (24.2%)	1 (12.5%)	19 (19.2%)	1 (25.0%)	2 (25.0%)	1 (25.0%)	21 (19.6%)	2 (25.0%)	**59 (22.3%)**	**3 (18.8%)**
Medium (4-10 hectares)	57 (39.9%)	2 (28.6%)	6 (42.9%)	1 (100%)	63 (40.1%)	3 (37.5%)	42 (42.4%)	0 (0.0%)	3 (37.5%)	1 (25.0%)	45 (42.1%)	1 (12.5%)	**108 (40.9%)**	**4 (25.0%)**
Large (10> hectares)	37 (25.9%)	4 (57.1%)	4 (28.6%)	0 (0.0%)	41 (26.1%)	4 (50.0%)	25 (25.3%)	3 (75.0%)	1 (12.5%)	1 (25.0%)	26 (24.3%)	4 (50.0%)	**67 (25.4%)**	**8 (50.0%)**
Total	**143 (95.3%)**	**7 (4.7%)**	**14 (93.3%)**	**1 (6.7%)**	**157 (95.2%)**	**8 (4.8%)**	**99 (96.1%)**	**4 (3.9%)**	**8 (66.7%)**	**4 (33.3%)**	**107 (93.0%)**	**8 (7.0%)**	**264 (94.3%)**	**16 (5.7%)**

Table 4.3.1 depicts number of respondents adopting soil preservation techniques with regard to their education and agricultural land holdings. It is apparent from the data that higher proportion of respondents, that is, 69 (26.1%) adopting soil preservation techniques were educated upto primary level, followed by 58 (22%) respondents who were illiterate. As many as 45 (17%) respondents were graduates who were opting soil preservation techniques. In Jandiala block, higher proportion of respondents adopting soil preservation techniques were educated upto primary level, followed by 29 (18.5%) respondents who were graduates. In relation to size of land holding, higher proportion of medium size land holdings, that is, 108 (40.9%) respondents were adopting soil preservation techniques, followed by 67 (25.4%) respondents of large size land holdings.

Table 4.3.2

Distribution of respondents on the basis of method of soil preservation adopted related with their education and income

	Method of soil preservation adopted						
	Using natural manure	**Using Chemical fertilizers**	**Practicing crop rotation**	**Natural manure and chemical fertilizers**	**Natural manure and crop rotation**	**Fertilizers and crop rotation**	**Grand Total**
Education							
Illiterate	0 (0.0%)	39 (26%)	3 (37.5%)	14 (20.9%)	3 (17.6%)	0 (0.0%)	**59 (22.3%)**
Literate	0 (0.0%)	11 (7.3%)	0 (0.0%)	3 (4.5%)	0 (0.0%)	0 (0.0%)	**14 (5.3%)**
Primary	0 (0.0%)	42 (28%)	0 (0.0%)	23 (34.3%)	3 (17.6%)	1 (25%)	**69 (26.1%)**
Secondary	1 (5.6%)	27 (18%)	0 (0.0%)	14 (20.9%)	3 (17.6%)	0 (0.0%)	**45 (17%)**
Higher Secondary	2 (11.1%)	15 (10%)	1 (12.5%)	7 (10.4%)	4 (23.5%)	0 (0.0%)	**29 (11%)**
Graduation	14 (77.8%)	16 (10.7%)	3 (37.5%)	6 (9.0%)	3 (17.6%)	3 (75%)	**45 (17%)**
Any other*	1 (5.6%)	0 (0.0%)	1 (12.5%)	0 (0.0%)	1 (5.9%)	0 (0.0%)	**3 (1.1%)**
Total	**18 (6.8%)**	**150 (56.8%)**	**8 (3.0%)**	**67 (25.4%)**	**17 (6.4%)**	**4 (1.5%)**	**264 (100%)**
Income (in Rupees)							
Upto1 lakh	2 (11.1%)	10 (6.7%)	1 (12.5%)	0 (0.0%)	0 (0.0%)	1 (25.0%)	**14 (5.3%)**
1-2 lakhs	3 (16.7%)	20 (13.3%)	2 (25.0%)	2 (3.0%)	0 (0.0%)	0 (0.0%)	**27 (10.2%)**
2-3 lakhs	4 (22.2%)	27 (18.0%)	0 (0.0%)	6 (9.0%)	1 (5.9%)	1 (25.0%)	**39 (14.8%)**
3-4 lakhs	3 (16.7%)	27 (18.0%)	2 (25.0%)	11 (16.4%)	4 (23.5%)	1 (25.0%)	**48 (18.2%)**
4-5 lakhs	3 (16.7%)	22 (14.7%)	1 (12.5%)	17 (25.4%)	2 (11.8%)	1 (25.0%)	**46 (17.4%)**
More than 5 lakhs	3 (16.7%)	44 (29.3%)	2 (25.0%)	31 (46.3%)	10 (58.8%)	0 (0.0%)	**90 (34. 1%)**
Grand Total	**18 (6.8%)**	**150 (56.8%)**	**8 (3.0%)**	**67 (25.4%)**	**17 (6.4%)**	**4 (1.5%)**	**264 (100%)**

Table 4.3.2 delineates the methods of soil preservation adopted by respondents corresponding to their educational qualification and annual income. Data illustrates that higher proportion of graduates, that is, 14 (77.8%) were using natural manure in their farm soil preservation and nourishment. Whereas, higher proportion of respondents, that is 42 (28%) using chemical fertilizers were educated upto primary level, followed by 39 (26%) respondents who were illiterate and using chemical fertilizers. As many as 3 (37.5%) respondents who were practicing crop rotation in their farm were illiterate. Also 3 (37.5%) respondents were graduates. Higher proportion of respondents, that is, 23 (34.3%) using both natural manure and chemical fertilizers in their farm were educated till primary level. Only 4 (23.5%) respondents educated till higher secondary were using natural manure and crop rotation. In terms of income, higher proportion of respondents, that is, 44 (29.3%) using chemical fertilizers were having income of more than Rupees 5 lakhs. It was observed from the table that respondents were equally distributed among various income groups for those who were using natural manure, practicing crop rotation and using fertilizers and crop rotation together. Whereas, higher proportion of respondents who were using natural manure with chemical fertilizers, 31 (46.3%) and natural manure with crop rotation, 10 (58.8%) were having income of more than Rupees 5 lakhs annually.

ADOPTION OF TRADITIONAL KNOWLEDGE AND TECHNIQUES:

Indigenous knowledge and skills pertains to experience gained through traditions over generation and passed orally (Norem, et al., 1988). Such knowledge is acquired by farmers from their forefathers and their fellow farmers. Before the advent of modern techniques and implements farmers used to practice such techniques to enhance the productivity and carry out the agricultural process. However, with the advancement of technology and inundation of new equipment's this traditional knowledge seems to be losing grounds. An attempt was made by the researcher to delve into the status of extent of adoption of such traditional techniques in this area (Obidike, 2011)

With the diminishing use of such traditional knowledge and practices, an attempt was made in this research to assess the application of such knowledge by the respondents. Following tables present insights into the adoption of traditional knowledge by the respondents.

Table 4.4

Distribution of respondents on the basis of adoption of traditional techniques

No. of farmers adopting trad. Tech	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Yes	78 (52.0%)	6 (40.0%)	84 (50.9%)	43 (41.7%)	3 (25.0%)	46 (40.0%)	**130 (46.4%)**
No	72 (48.0%)	9 (60.0%)	81 (49.1%)	60 (58.3%)	9 (75.0%)	69 (60.0%)	**150 (53.6%)**
Total	**150 (53.5%)**	**15 (5.3%)**	**165 (58.9%)**	**103 (36.7%)**	**12 (4.2%)**	**115 (41.1%)**	**280 (100%)**

Table 4.4 highlights the traditional techniques adopted by the respondents in their farms. It shows that a fair proportion, 130(46.4%) of respondents were seen practising traditional techniques along with modern techniques, whereas 150 (53.6%) respondents were not practising any traditional technique. They were seen relying solely on other latest techniques. There was higher proportion of respondents in Jandiala block, that is, 84 (50.9%) practising traditional techniques in their farm compared to 46 (40.0%) respondents in Ajnala block.

Table 4.4.1

Distribution of respondents on the basis of adopting traditional techniques related with their education and size of land holding

	Traditional techniques													
	Manawala		Dhirakot		Total		Panj garain wala		Kotli jimmat singh		Total		Total	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Education														
Illiterate	11 (14.1%)	14 (19.4%)	2 (33.3%)	1 (11.1%)	13 (15.5%)	15 (18.5%)	14 (32.6%)	15 (25.0%)	1 (33.3%)	2 (22.2%)	15 (32.6%)	17 (24.6%)	**28 (21.5%)**	**32 (21.3%)**
Literate	2 (2.6%)	2 (2.8%)	0 (0.0%)	0 (0.0%)	2 (2.4%)	2 (2.5%)	3 (7.0%)	6 (10.0%)	0 (0.0%)	1 (11.1%)	3 (6.5%)	7 (10.1%)	**5 (3.8%)**	**9 (6.0%)**
Primary	25 (32.1%)	14 (19.4%)	2 (33.3%)	4 (44.4%)	27 (32.1%)	18 (22.2%)	13 (30.2%)	12 (20.0%)	0 (0.0%)	3 (33.3%)	13 (28.3%)	15 (21.7%)	**40 (30.8%)**	**33 (22.0%)**
Secondary	18 (23.1%)	6 (8.3%)	2 (33.3%)	2 (22.2%)	20 (23.8%)	8 (9.9%)	9 (20.9%)	8 (13.3%)	1 (33.3%)	0 (0.0%)	10 (21.7%)	8 (11.6%)	**30 (23.1%)**	**16 (10.7%)**
Higher Secondary	11 (14.1%)	11 (15.3%)	0 (0.0%)	1 (11.1%)	11 (13.1%)	12 (14.8%)	2 (4.7%)	3 (5.0%)	1 (33.3%)	0 (0.0%)	3 (6.5%)	3 (4.3%)	**14 (10.8%)**	**15 (10.0%)**
Graduation	10 (12.8%)	21 (29.2%)	0 (0.0%)	1 (11.1%)	10 (11.9%)	22 (27.2%)	2 (4.7%)	15 (25.0%)	0 (0.0%)	3 (33.3%)	2 (4.3%)	18 (26.1%)	**12 (9.2%)**	**40 (26.7%)**
Any other*	1 (1.3%)	4 (5.6%)	0 (0.0%)	0 (0.0%)	1 (1.2%)	4 (4.9%)	0 (0.0%)	1 (1.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.4%)	**1 (0.8%)**	**5 (3.3%)**
Total	**78 (52.0%)**	**72 (48.0%)**	**6 (40.0%)**	**9 (60.0%)**	**84 (50.9%)**	**81 (49.1%)**	**43 (41.7%)**	**60 (58.3%)**	**3 (25.0%)**	**9 (75.0%)**	**46 (40.0%)**	**69 (60.0%)**	**130 (46.4%)**	**150 (53.6%)**
Size of land holding														
Marginal (<1 hectare)	0 (0.0%)	4 (5.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (4.9%)	1 (2.3%)	5 (8.3%)	1 (33.3%)	2 (22.2%)	2 (4.3%)	7 (10.1%)	**2 (1.5%)**	**11 (7.3%)**
Small (1-2 hectares)	5 (6.4%)	3 (4.2%)	1 (16.7%)	2 (22.2%)	6 (7.1%)	5 (6.2%)	3 (7.0%)	4 (6.7%)	0 (0.0%)	0 (0.0%)	3 (6.5%)	4 (5.8%)	**9 (6.9%)**	**9 (6.0%)**
Semi-medium (2-4 hectares)	20 (25.6%)	18 (25.0%)	1 (16.7%)	0 (0.0%)	21 (25.0%)	18 (22.2%)	7 (16.3%)	13 (21.7%)	1 (33.3%)	2 (22.2%)	8 (17.4%)	15 (21.7%)	**29 (22.3%)**	**33 (22.0%)**
Medium (4-10 hectares)	37 (47.4%)	22 (30.6%)	1 (16.7%)	6 (66.7%)	38 (45.2%)	28 (34.6%)	19 (44.2%)	23 (38.3%)	1 (33.3%)	3 (33.3%)	20 (43.5%)	26 (37.7%)	**58 (44.6%)**	**54 (36.0%)**
Large (10> hectares)	16 (20.5%)	25 (34.7%)	3 (50.0%)	1 (11.1%)	19 (22.6%)	26 (32.1%)	13 (30.2%)	15 (25.0%)	0 (0.0%)	2 (22.2%)	13 (28.3%)	17 (24.6%)	**32 (24.6%)**	**43 (28.7%)**
Total	**78 (52.0%)**	**72 (48.0%)**	**6 (40.0%)**	**9 (60.0%)**	**84 (50.9%)**	**81 (49.1%)**	**43 (41.7%)**	**60 (58.3%)**	**3 (25.0%)**	**9 (75.0%)**	**46 (40.0%)**	**69 (60.0%)**	**130 (46.4%)**	**150 (53.6%)**

Table 4.4.1 depicts that higher proportion of respondents, that is, 40 (30.8%) educated till primary level were using traditional techniques in their farm, followed by 30 (23.1%) respondents educated till secondary level. As many as 28 (21.5%) respondents who were illiterate were using traditional techniques in their farm. On the other hand, higher proportion of graduate respondents, 40 (26.7%) were seen not using traditional techniques in their farm. In Jandiala block, higher proportion of respondents, that is, 27 (32.1%) who were primary level educated, followed by 20 (23.8%) respondents who studied till secondary level were using traditional techniques in their farm. Whereas, in Ajnala block, higher proportion of illiterate respondents 15 (32.6%) were using traditional techniques, followed by 13 (28.3%) who were educated up to primary level. This shows that most of the well-educated respondents were not adopting traditional techniques of agriculture rather were going in for new techniques such as not opting for stubble burning rather selling the residue or making manure out of it and applying chemicals fertilizers and pesticides only. In terms of size of land holdings, higher proportion of respondents, that is, 58 (44.6%) were having medium size land holdings and practicing traditional techniques, followed by 32 (24.6%) respondents having large size land holdings. In both the blocks, medium size land holding respondents were seen using traditional techniques in their farms accounting to 38 (45.2%) and 20 (43.5%) in Jandiala block and Ajnala block respectively.

Table 4.4.2

Distribution of respondents on the basis of traditional techniques pursued

Traditional techniques adopted	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Use of recycled manure (Rudhi)	28 (35.9%)	2 (33.3%)	30 (35.7%)	5 (11.6%)	2 (66.7%)	7 (15.2%)	**37 (28.5%)**
Tudhi and Rudhi	19 (24.4%)	0 (0.0%)	19 (22.6%)	11 (25.6%)	0 (0.0%)	11 (23.9%)	**30 (23.1%)**
Stubble burning	10 (12.8%)	1 (16.7%)	11 (13.1%)	12 (27.9%)	0 (0.0%)	12 (26.1%)	**23 (17.7%)**
Using residue of wheat (Tudhi)	6 (7.7%)	1 (16.7%)	7 (8.3%)	12 (27.9%)	1 (33.3%)	13 (28.3%)	**20 (15.4%)**
Stubble burning & Tudhi	5 (6.4%)	0 (0.0%)	5 (6.0%)	1 (2.3%)	0 (0.0%)	1 (2.2%)	**6 (4.6%)**
Stubble burning & Rudhi	6 (7.7%)	1 (16.7%)	7 (8.3%)	1 (2.3%)	0 (0.0%)	1 (2.2%)	**8 (6.2%)**
Spraying chillies as insecticides	1 (1.3%)	1 (16.7%)	2 (2.4%)	1 (2.3%)	0 (0.0%)	1 (2.2%)	**3 (2.3%)**
Chilly spray and Tudhi	2 (2.6%)	0 (0.0%)	2 (2.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**2 (1.5%)**
Chilly spray and Rudhi	1 (1.3%)	0 (0.0%)	1 (1.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**1 (0.8%)**
TOTAL	**78 (60.0%)**	**6 (4.6%)**	**84 (64.6%)**	**43 (33.1%)**	**3 (2.3%)**	**46 (35.4%)**	**130 (100%)**

The cursory glance at the table 4.4.2 it is observed that there were mixed responses in regard to various traditional techniques adopted by the farmers in these villages. 37 (28.5 %) were using recycled manure (Rudhi) in their farms, followed by 30(23.1%) respondents who were using combination of residue of wheat (Tudhi) and recycled manure (Rudhi). 23 (17.7%)respondents were observed burning stubble also called *"Paraali"* and *"Naadh'* in which residue of crops are burned after harvesting, it created air pollution and kills the naturally present helpful insects in the soil. Land should remain fallow to regain its nutrients but it was further observed that not much time was given for soil to rejuvenate its strength and fertility which makes soil vulnerable to infertility. A little proportion of respondents 20 (15.4%) were using residue of wheat (Tudhi) in their farm. 8 (6.2%) respondents were burning stubble

along with applying Rudhi in their farm, 6 (4.6%) respondents were using slash and burn with Tudhi. A small proportion of respondents, that is, 3(2.3%) and 2 (1.5%) were found practicing spraying chillies spray as pesticide and chillies spray in combination with Tudhi and Rudhi respectively. Table reveals that higher proportion of respondents from Ajnala block 12 (26.1%) were observed practicing stubble burning compared to 11 (13.1%) respondents from Jandiala block.

AGRO FORESTRY

Trees play vital role in maintaining the equilibrium in ecosystem in all terrestrials. Along with this, trees provide humans with range of products and services. Agro-forestry is a practice which deals with integrating trees into agricultural system for deriving the benefits of trees into agriculture (Tiwari, 2008). The National Agriculture Policy (2000) emphasized the role of agroforestry for efficient nutrient cycling, nitrogen fixation, organic matter addition and for improving drainage and underlining the need for diversification by promoting integrated and holistic development of rainfed areas on watershed basis through involvement of community to augment biomass production through agroforestry and farm forestry (Yadav, 2010). According to the Punjab Remote Sensing Centre (PRSC, 2006), out of total geographical area in the state, only 0.37% (188 km^2) area is under agro forestry plantations. Thus, the respondents were probed about agro-forestry in their farms.

Table 4.5

Number of respondents who planted trees in their farm

Planted Trees	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Yes	33 (22.0%)	1 (6.7%)	34 (20.6%)	38 (36.9%)	2 (16.7%)	40 (34.8%)	**74 (26.4%)**
No	117 (78.0%)	14 (93.3%)	131 (79.4%)	65 (63.1%)	10 (83.3%)	75 (65.2%)	**206 (73.6%)**
Total	**150 (53.5%)**	**15 (5.3%)**	**165 (58.9%)**	**103 (36.7%)**	**12 (4.2%)**	**115 (41.1%)**	**280 (100%)**

Table 4.5 illustrates the number of farmers who planted trees in their farms. It shows that little proportion of respondents 74(26.4%) grow trees in their farms. Ajnala block have higher proportion of farmers who planted trees, that is, 40(34.8%) in comparison to Jandiala block which have 34 (20.6%) respondents who have

planted trees in their farm. Within Ajnala block Panj garain wala had higher proportion of respondents 39 (36.9%) who adopted agro forestry in their farm. Reason stated by respondents for pursuing agro forestry was additional source of income and remunerative return from growing Poplar tree. It was observed that Poplar is found to have prominence in this area. Poplar is grown for commercial purpose as it grows at faster pace and its wood is used in plywood, sports goods and paper industry. Lack of interest, less space and inadequate returns were mentioned as reason of not growing the trees in the farm by the respondents.

Table 4.5.1

Distribution of respondents on the basis of growing trees related with their income and education

	Tree growers		
	Yes	**No**	**Total**
Income (in Rupees)			
Upto1 lakh	3 (4.1%)	12 (5.8%)	**15 (5.4%)**
1-2 lakhs	6 (8.1%)	23 (11.2%)	**29 (10.4%)**
2-3 lakhs	8 (10.8%)	36 (17.5%)	**42 (15.0%)**
3-4 lakhs	13 (17.6%)	39 (18.9%)	**52 (18.6%)**
4-5 lakhs	17 (23.0%)	31 (15.0%)	**48 (17.1%)**
More than 5 lakhs	27 (36.5%)	67 (32.5%)	**94 (33.6%)**
Total	**74 (26.4%)**	**206 (73.6%)**	**280 (100%)**
Education			
Illiterate	12 (16.2%)	48 (23.3%)	**60 (21.4%)**
Literate	3 (4.1%)	11 (5.3%)	**14 (5.0%)**
Primary	19 (25.7%)	54 (26.2%)	**73 (26.1%)**
Secondary	11 (14.9%)	35 (17.0%)	**46 (16.4%)**
Higher Secondary	4 (5.4%)	25 (12.1%)	**29 (10.4%)**
Graduation	22 (29.7%)	30 (14.6%)	**52 (18.6%)**
Any other*	3 (4.1%)	3 (1.5%)	**6 (2.1%)**
Total	**74 (26.4%)**	**206 (73.6%)**	**280 (100%)**

Table 4.5.1 indicate that higher proportion of tree growers, 27 (36.5%) had income of more than Rupees 5 lakhs annually, followed by 17 (23%) respondents who were having income of Rupees 4-5 lakhs. This shows that more number of tree growers were having higher income. In terms of education, it was found that higher proportion of tree growers were graduates, that is, 22 (29.7%). It indicates that more educated farmers tend to grow trees in their farm which are useful to them.

Those respondents who answered 'yes' were further asked how many trees were planted by them in their farm.

Table 4.5.2

Distribution of respondents on the basis of number of trees planted in their farm

No. of trees planted	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Upto 20	16 (48.5%)	0 (0.0%)	16 (47.1%)	1 (2.6%)	0 (0.0%)	1 (2.5%)	**17 (23.0%)**
20-50	2 (6.1%)	0 (0.0%)	2 (5.9%)	2 (5.3%)	2 (100.0%)	4 (10.0%)	**6 (8.1%)**
50-100	9 (27.3%)	0 (0.0%)	9 (26.5%)	13 (34.2%)	0 (0.0%)	13 (32.5%)	**22 (29.7%)**
100-150	5 (15.2%)	1 (100.0%)	6 (17.6%)	8 (21.1%)	0 (0.0%)	8 (20.0%)	**14 (18.9%)**
More than 150	1 (3.0%)	0 (0.0%)	1 (2.9%)	14 (36.8%)	0 (0.0%)	14 (35.0%)	**15 (20.3%)**
TOTAL	**33 (44.6%)**	**1 (1.4%)**	**34 (45.9%)**	**38 (51.4%)**	**2 (2.7%)**	**40 (54.1%)**	**74 (100%)**

Table 4.5.2 shows the number of trees planted in the farms. It is evident from the table that 24 (8.2%) respondents grew up to 50 trees in their farm, followed by 22 (7.9%) respondents who had trees in the range between 50 to 100. As many as 15 (5.4%) respondents were having more than 150 trees in their farm and 14 (5 %) respondents were having 100 to 150 number of trees. It is observed from the data that most of the farmers from Jandiala block had upto 50 trees and farmers of Ajnala block had more than 150 numbers of trees. It indicates that farmers of Ajnala block grew trees in larger proportion than in Jandiala block.

LIVESTOCK

Livestock are capital assets which augment the income of the farmers by contributing to future product output. Acquisition of livestock assist the farmer in raising farm production by extending the area that can be utilised, diversifying the activities in farm and intensification of livestock value, therefore increasing production per hectare of agricultural land. In integrated farming system, livestock contribute in diversification of on-farm income (Thornton *et al* 2002). Livestock help in buffer shocks and stresses. It can help in risk mitigation by providing means of subsistence in case of crop failure. Apart from economic dimension, livestock serves the social and cultural functions, considering their special role in some religious ceremonies and occasions (Upton, 2004). On this account, it became needful to consider the condition of livestock in the research area to determine to what extent integrated farming is being practiced. In the following tables respondents were probed whether they had livestock and further they were inquired about the classification of livestock reared by them.

Table 4.6

Distribution of respondents on the basis of having livestock in their farm

Having livestock	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Yes	87 (58.0%)	3 (20.0%)	90 (54.5%)	36 (35.0%)	4 (33.3%)	40 (34.8%)	**130 (46.4%)**
No	63 (42.0%)	12 (80.0%)	75 (45.5%)	67 (65.0%)	8 (66.7%)	75 (65.2%)	**150 (53.6%)**
Total	**150 (53.5%)**	**15 (5.3%)**	**165 (58.9%)**	**103 (36.7%)**	**12 (4.2%)**	**115 (41.1%)**	**280 (100%)**

Table 4.6 takes into account the number of farmers which keep livestock with them. Table illustrate that almost half of the respondents 130(46.4%) kept livestock with them. It was observed from the table that respondents of Jandiala block 90 (54.5%) were having livestock in more proportion than respondents of Ajnala block 40 (34.8%). Livestock are assets which not only help in diversifying the income of farmers but also increase the income earned. Those respondents who answered ‘yes’ were further asked what kind of livestock did they have.

Table 4.6.1

Distribution of respondents on the basis of livestock reared

Livestock reared	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Buffalo	65 (74.7%)	1 (33.3%)	66 (73.3%)	32 (88.9%)	4 (100.0%)	36 (90.0%)	**102 (78.5%)**
Cow	13 (14.9%)	1 (33.3%)	14 (15.6%)	4 (11.1%)	0 (0.0%)	4 (10.0%)	**18 (13.8%)**
Goats	1 (1.1%)	0 (0.0%)	1 (1.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**1 (0.8%)**
Sheep	1 (1.1%)	0 (0.0%)	1 (1.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**1 (0.8%)**
Poultry							
Chicken	4 (4.6%)	1 (33.3%)	5 (5.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**5 (3.8%)**
Hens	3 (3.4%)	0 (0.0%)	3 (3.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**3 (2.3%)**
TOTAL	**87 (66.9%)**	**3 (2.3%)**	**90 (69.2%)**	**36 (27.7%)**	**4 (3.1%)**	**40 (30.8%)**	**130 (100%)**

From the cursory glance of the table 4.6.2 it is observed that majority of respondents that is 102 (78.5%) were having buffalo, followed by 18 (13.8%) respondents who kept cows. As much as 5 (3.8%) respondents were having chicken. A small proportion of farmers kept goats 1 (0.4%), sheep 1 (0.8%), and hens 3 (2.3%). It shows the prominence of buffalo as a livestock in this area. Reason of keeping buffalo can be attributed to the lifestyle of the farmers and the local people as people diet primarily includes milk, butter and clarified butter obtained from the buffalo or cow's milk.

KEEPING HELPFUL INSECTS/NATURAL PESTS

In the era of rampant implementation of diverse chemical inputs, it is crucial to integrate naturally occurring control measures to develop integrated pest management strategies. Assimilating biological agents, cultural practices in conjunction with chemicals may aid controlling the pest and diseases. Beneficial insects help in regulating the ecosystem in the manner that it naturally regulates the plant pest, aid in pollination and conserve the natural elements. Some of the essential constituents of beneficial insects are listed below:

Pollinators: There are insect's pollinators who forage on flowering plants to obtain pollen (or nectar) and transfer to female gametes resulting in pollination.

Natural enemies: They are insect's predators who feed on insects particularly insects pest and act natural enemies.

Weed killer: These insects feed on weed that inhibits the crop growth and dispense with the function of weed eradication.

Soil building: Burrowing of such insects helps in improving the physical structure as they create channels which aids root penetration and aeration (Getanjaly et.al, 2015)

In the following tables information was gathered from respondents on what kind of insects are beneficial in agriculture and further they were questioned about regarding keeping any such insects in their farm.

Table 4.7

Distribution of respondents on the basis of knowledge about helpful insects

Helpful insects	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Earthworms	88 (58.7%)	9 (60.0%)	97 (58.8%)	49 (47.6%)	12 (100.0%)	61 (53.0%)	**158 (56.4%)**
Honey bees	10 (6.7%)	2 (13.3%)	12 (7.3%)	7 (6.8%)	0 (0.0%)	7 (6.1%)	**19 (6.8%)**
Both	1 (0.7%)	1 (6.7%)	2 (1.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**2 (0.7%)**
Don't know about them	51 (34.0%)	3 (20.0%)	54 (32.7%)	47 (45.6%)	0 (0.0%)	47 (40.9%)	**101 (36.1%)**
Total	**150 (53.5%)**	**15 (5.3%)**	**165 (58.9%)**	**103 (36.7%)**	**12 (4.2%)**	**115 (41.1%)**	**280 (100%)**

Table 4.7 enumerates the responses of respondents when asked to name the beneficial insects in the farming. It is evident from the table that higher proportion of respondents 158 (56.4%) stated that earthworms are beneficial insect in the farming, followed by 19 (6.8%) respondents who told honey bee is beneficial and only 2 (0.7%) respondents said both earthworm and honey bee are beneficial. However, fair proportion of respondents, that is, 101 (36.1%) did not know about beneficial insects in the farming. Among the blocks, higher proportion of respondents from Ajnala block, 47 (40.9%) reported to have no awareness regarding the beneficial insects. Further, Panj garain wala village had highest number of respondents having no awareness of beneficial insects.

Table 4.7.1

Distribution of respondents on the basis of keeping helpful insects in their farm

Keeping insects	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Yes	38 (25.3%)	0 (0.0%)	38 (23.0%)	4 (3.9%)	1 (8.3%)	5 (4.3%)	**43 (15.4%)**
No	112 (74.7%)	15 (100.0%)	127 (77.0%)	99 (96.1%)	11 (91.7%)	110 (95.7%)	**237 (84.6%)**
Total	**150 (53.5%)**	**15 (5.3%)**	**165 (58.9%)**	**103 (36.7%)**	**12 (4.2%)**	**115 (41.1%)**	**280 (100%)**

Respondents were further asked about whether they kept beneficial insects or not. Table 4.7.1 marked the responses of the respondents. It is observed from the table that very few respondents, 43 (15.4%) out of total 280 respondents admitted that they have kept the beneficial insects and higher proportion, 237 (84.6%) respondents had not kept beneficial insects. It is indicated in the table that higher proportion of respondents, 38 (23.0%) from Jandiala block (most of them were from Manawala village) kept beneficial insects in comparison to 5 (4.3%) respondents of Ajnala block. These had a positive effect on their agricultural produce both quality and quantity wise.

Table 4.7.2

Distribution of respondents on the basis of kind of helpful insects kept by them

Insects kept by respondents	Jandiala block			Ajnala block			Total
	Manawala	Dhirakot	Total	Panj garain wala	Kotli jimmat singh	Total	
Earthworms	35 (92.1%)	0 (0.0%)	35 (74.5%)	2 (50.0%)	1 (100.0%)	3 (60.0%)	**38 (88.4%)**
Honey bees	3 (7.9%)	0 (0.0%)	3 (6.4%)	2 (50.0%)	0 (0.0%)	2 (40.0%)	**5 (11.6%)**
TOTAL	**38 (88.4%)**	**0 (0.0%)**	**38 (88.4%)**	**4 (9.3%)**	**1 (2.3%)**	**5 (11.6%)**	**43 (100%)**

Table 4.7.2 describes the insects which were kept by the respondents in their farm to increase the fertility of the soil and for the soil preservation. It is highlighted in the table that most of the respondents 38 (88.4%) out of total 43 who kept insects were rearing earthworms in their field whereas 5 (11.6%) respondents kept honey bees. Respondents kept honey bees as the part time occupation also as they can sell the honey and earn from it.

Table 4.7.3

Distribution of respondents on the basis of keeping helpful insects related with their education and size of land holding

	Respondents keeping helpful insects		
	Yes	**No**	**Total**
Education			
Illiterate	8 (18.6%)	52 (21.9%)	**60 (21.4%)**
Literate	0 (0.0%)	14 (5.9%)	**14 (5.0%)**
Primary	11 (25.6%)	62 (26.2%)	**73 (26.1%)**
Secondary	9 (20.9%)	37 (15.6%)	**46 (16.4%)**
Higher Secondary	3 (7.0%)	26 (11.0%)	**29 (10.4%)**
Graduation	8 (18.6%)	44 (18.6%)	**52 (18.6%)**
Any other*	4 (9.3%)	2 (0.8%)	**6 (2.1%)**
Total	**43 (15.4%)**	**237 (84.6 %)**	**280 (100.0%)**
Size of land holding			
Marginal (<1 hectare)	0 (0.0%)	13 (5.5%)	**13 (4.6%)**
Small (1-2 hectares)	2 (4.7%)	16 (6.8%)	**18 (6.4%)**
Semi-medium (2-4 hectares)	7 (16.3%)	55 (23.2%)	**62 (22.1%)**
Medium (4-10 hectares)	20 (46.5%)	92 (38.8%)	**112 (40.0%)**
Large (10> hectares)	14 (32.6%)	61 (25.7%)	**75 (26.8%)**
Total	**43 (15.4%)**	**237 (84.6 %)**	**280 (100.0%)**

Table 4.7.3 suggests the number of respondents who were keeping the helpful insects in their farm with reference to their education and the farm size. Data points out that higher proportion of respondents keeping helpful insects were educated upto primary level, that is, 11 (25.6%) followed by respondents who had done education till secondary level, that is, 9 (20.9%) and graduates that is, 8 (18.6%). Moreover, among those respondents who were keeping helpful insects in their farm higher proportion of them were farmers having medium size land holdings, that is, 20 (46.5%) followed by farmers having large size land holdings, that is, 14 (32.6%) and farmers with semi-medium size land holdings, that is, 7 (16.3%).

SUMMARY:

Hence, the picture which emerges out from the aforesaid discussion presents the various facets of awareness among the respondents. Firstly, it was noted that majority of respondents were not aware of the concept of sustainable agriculture, among them higher proportion of respondents were educated upto primary level or were illiterate. Whereas, higher proportion of graduates respondents were found having awareness of concept of agriculture highlighting the significance of education on the extent of awareness. Secondly, as far practising sustainable agriculture is concerned around one-fifth of the respondents were practising sustainable agriculture with higher proportion of respondents who were graduates and were having medium size land holdings. Among the practice of sustainable agriculture pursued by the respondents, use of natural manure, recycling crop waste and mixed cropping were more pronounced. Out of the methods adopted for soil enrichment, majority of respondents found using chemical fertilizers, followed by using chemical fertilizers along with natural manure. While higher proportion of respondents done graduation using natural manure in their farm, higher proportion of respondents educated upto primary level were using chemical fertilizers. About half of the respondents were found adopting traditional techniques in their farm with higher proportion of the respondents among them were educated upto primary level and illiterate and belongs to the category of medium size land holding. Out of the traditional techniques being employed use of recycled manure (Rudhi) was found being practised profoundly, followed by using residue of wheat (Tudhi) along with recycled manure and stubble burning.

In terms of respondents who were growing tress in the farm, it was found that higher proportion of respondents were having income of more than 5 lakhs and were graduates. A substantial proportion of respondents found rearing livestock, out of which higher proportion of respondents were having buffaloes followed by cows. Less proportion of respondents were keeping helpful insects in their farm. Among the respondents keeping helpful insects, most of them were educated upto primary level and secondary level. Honey bees and earthworm were kept by majority of respondents.