A Study on Adoption Level of Different Recommended Agricultural Practices by Farmers in Kharar Division of Punjab

Anand Vikas Hansda [a*], Satyabrata Sahoo [a] and Gurshaminder Singh [a]

[a] UIAS, Chandigarh University, Gharuan, Mohali-140413, Punjab, India.

Original Research Article

ABSTRACT

Since agriculture employs half of all workers worldwide, it is the largest employer and the economic engine of rural India. Rural India's development in relation to national development would be reflected in the development of agriculture [1]. Agriculture and allied industries are without a doubt the greatest employer in India, particularly in the vast rural areas. A vital basis for the Gross Domestic Product (GDP) is also provided by it. The agriculture industry in India contributes considerably to the economy, accounting for around 18.3% of Gross Domestic Product (GDP). All of the procedures that a farmer follows from seed to seed, from seed sowing through seed harvesting and storage, are referred to as agronomical practices. A study on agronomic practices followed by 120 farmers from five villages viz. Shakrullapur (28 farmers), Rora (30 farmers), Bibipur (22 farmers), Batta (18 farmers) and Fatehpur-Theri (22 farmers) was considered.The data

collected from the respondents include major crops grown, seed rate followed by respondents, fertilizer dose followed, major weeds affecting, major plant diseases, major insect and pests, harvesting methods and yield records. As per the data collected, wheat is cultivated by nearly 87% of the farmers in this region and 100% farmers who are growing wheat, agreed that the *Phalaris minor* is the major weed affecting the wheat production. The data collected from the farmers shows that, only 59% of the farmers are following recommended seed rate. Sheath blight and Yellow rust are the two major diseases affecting paddy and wheat respectively. And the major pests affecting the production in rice and wheat are grasshoppers and aphids respectively.In order to secure the best crop growth and highest yields, the study's findings showed that farmers used the most recent technology in the fields.

1. INTRODUCTION

The largest sector of the Indian economy is agriculture. In the last 20 years, it has seen a rapid shift as a result of the policies of globalization and liberalization that have created new opportunities for agriculture. Due to investments in the sector, this has sparked not just commercialization and diversification but also a number of technological and institutional improvements [2]. A nation's economic development is strategically aided by the agricultural sector. It has already had a significant impact on the economic success of developed countries, and it is essential for the developing countries' economic growth. In other words, the focus is on agriculture and other primary industries where per capita real income is low. One of the most established financial sectors in our country is agriculture. Different districts use different development strategies. Undoubtedly the largest source of employment in India is agriculture and its related sectors, especially in the vast rural areas. Additionally, it provides a crucial foundation for the Gross Domestic Product (GDP). In India, the agricultural sector contributes significantly to the economy, making up about 18.3% of GDP. India's population depends on it for survival to the tune of about 62% [3]. Given that it accounts for roughly 18.3% of GDP, agriculture is a vital sector of the Indian economy [4].

In rural India, the main source of employment is agriculture, which accounts for half of all employment worldwide [5]. Nearly 58% of Indians' income comes from agriculture, and their population is still expanding quickly [6]. Agriculture contributes $400 billion to India's GDP, which is second only to China [5]. Due to the human resources in Punjab that could take advantage of the quick advancements in science and technology, the agricultural sector has made enormous strides. The expansion of state agriculture in sustaining the country's food security and other agricultural development-related endeavors can be credited to their united efforts and the availability of competent labour [7]. According to Census 2001, 39% of the workforce in Punjab was employed in agriculture. In 2011, this decreased to 35.6% (the Labour Bureau's 2015–16 data puts it at 34%) [8].

Wheat (*Triticumaestivum* L.), the most important cereal crop in the world, is a staple food for around one-third of the world's population [9]. It accounts for about 21% of all cultivated land (30.597 million hectares) and about 35% of the nation's total food production (98.38 million tonnes) (2016–17) [10]. For India's food security and economic growth, rice (*Oryza sativa*), a staple crop, is essential [11]. It provides over one-fourth of all caloric intake and occupies more than one-fifth of all gross cropland [12].

A vital component of the sustainability of food systems is agricultural technology. An illustration of how scale-independent technology has changed agricultural productivity is the Green Revolution. The Green Revolution has improved harvests, decreased poverty, built infrastructure, increased access to food, and decreased food prices, among other things [13]. A farmers activities from seed to seed are referred to as farming practices from planting to producing and storing the seeds. The relationship between agronomic practices and yields is direct. Farmers must use the finest agricultural techniques for the season and agro-climatic zone in order to get optimum harvests. By region, these traditions change. It has been crucial in assuring improved agricultural practices in nations like India, allaying worries that the country has reached the point of food excess, which happens when population growth outpaces agricultural production. India is second in the world for

agricultural production despite having a little portion of the world's agricultural land.

2. MATERIALS AND METHODS

The study was conducted in Kharar block, district SAS Nagar (Punjab) from which five villages were selected randomly:Shakrullapur, Rora, Bibipur, Batta and Fatehpur-Theri.A total of 28 respondents were selected from village Shakrullapur, 30 were from Rora, 22 were from Bibipur, 18 were from Batta and 22 respondents were from Fatehpur-Theri, making total sample of 120 farmers for the study. A detailed interaction was directed with the farmers regarding their social status, and the Agronomical practices they follow throughout the year. The respondents were interviewed at their homes and in their fields. A schedule of interviews was created to examine each parameter properly and sequentially in order to cover every aspect of the farmers' agronomical operations. After data collection from the farmers, data were classified and analyzed with the help of suitable statistical measures such as percentages, graphical representation, bar graphs, and Pie charts.

Formulae used for calculation:

$$\text{Percentage} = \frac{\text{Number of respondents}}{\text{Total number of respondents}} * 100$$

$$\text{Average} = \frac{\text{Sum of total observations}}{\text{Total number of observations}}$$

3. RESULTS AND DISCUSSION

3.1 Major Crops Grown by the Farmers

The data represented in the Table 1, the major crops grown by the farmers in their respective villages. As per the data collected overall, 87% farmers are growing wheat, 85% farmers are growing paddy and 52% farmers are growing mustard. Apart from these crops, 44% farmers are growing sugarcane, 41% farmers are growing berseem as a fodder crop, 35% farmers are growing maize, 34% farmers are growing bajra and 31% farmers are growing sorghum. Vegetable crops are grown less in this region. Less than 10% farmers are growing potato and onion.

3.2 Seed Rate Followed by the Farmers

The data represented in Table 2 shows the total percentage of farmers using seeds less than the recommended rate, recommended rate and above the recommended rate.As per the data, most of the farmers are using recommended seed rate. In Shakrullapur village 7% farmers are using seeds below the recommended rate, 61% farmers using recommended seed rate and 32% farmers are using above recommended rate. In Rora village 10% farmers are using seeds below recommended rate, 53% farmers are using recommended rate and 37% farmers are using above recommended rate. In Bibipur village 55% farmers are using recommended seed rate and 45% farmers are using above than recommended seed rate. In Batta village 11% farmers are using below recommended seed rate, 61% farmers are using recommended seed rate and 28% farmers are using above than the recommended seed rate. In the Fatehpur-theri village 68% farmers are using recommended seed rate and 32% farmers are using more than recommended seed rate.

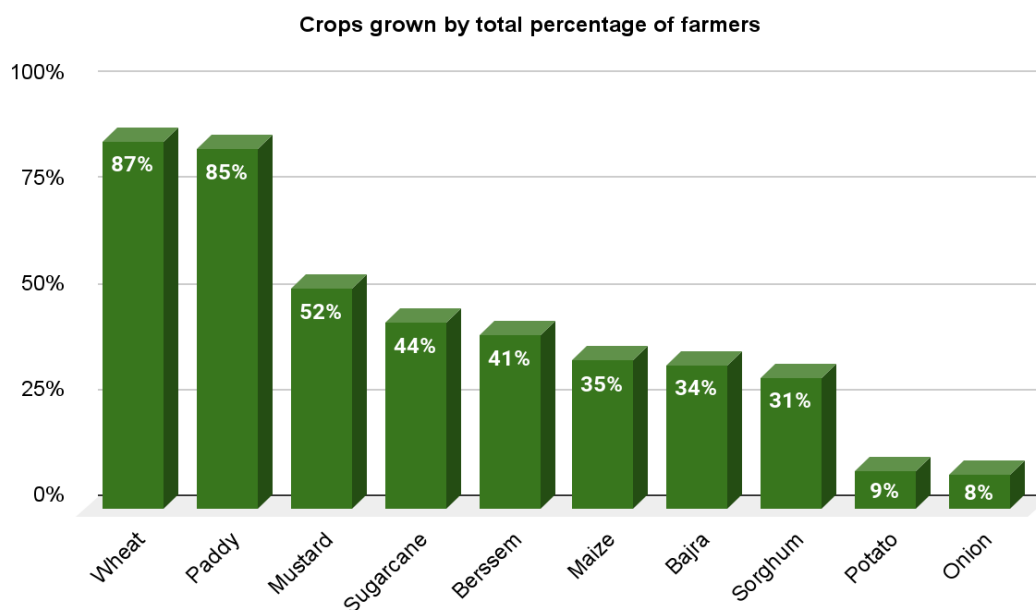### 3.3 Fertilizer Dose Applied by the Farmers

According to the Table 1, major crops grown by the farmers of these villages are wheat, paddy, mustard and sugarcane. The results showing in Table 3 depicts that the overall mean amount of fertilizers used by the respondents are more than the recommended doses. The recommended dose for the wheat crop is 120N: 60P: 40K [14], recommended dose for the paddy crop is 125N: 30P: 30K [15], the recommended dose for mustard crop is 130N: 120P [14] and the recommended dose for sugarcane is 300N:100P:200K [15]. The results revealed that the farmers are using excess fertilizers doses in all crops. Potassium (K) fertilizers are given less importance when compared to nitrogenous and phosphoric fertilizer respectively. However, most of these fertilizer application do not take into account the needs of the soil for nitrogen (N), phosphorus (P), and potassium (K).

3.4 Major Weeds

The Table 4 showing different kinds of weeds (Crop specific) are present in their fields throughout the year. The main weed that all of the responders saw was *Phalaris minor* (87%). According to them, this weed shows resistance to most of the chemicals used to eradicate or eliminate this weed. It reduces the yield up to a significant level. This is the major concern of the farmers during the Rabiseason, especially in wheat crop.

Table 1. Major crops grown by respondent farmers

Sr. No.	Crops grown	Shakrullapur (n=28)	Rora (n=30)	Bibipur (n=22)	Batta (n=18)	Fatehpur-Theri (n=22)	Overall (N=120)
1	Wheat	22 (79%)	28 (93%)	20 (91%)	15 (83%)	20 (91%)	105 (87%)
2	Paddy	18 (64%)	28 (93%)	22 (100%)	12 (67%)	22 (100%)	102 (85%)
3	Mustard	12 (43%)	13 (43%)	10 (45%)	11 (61%)	16 (73%)	62 (52%)
4	Sugarcane	13 (46%)	10 (33%)	14 (64%)	6 (33%)	10 (45%)	53 (44%)
5	Berseem	10 (36%)	11 (37%)	7 (32%)	11 (61%)	10 (45%)	49 (41%)
6	Maize	15 (54%)	8 (27%)	4 (18%)	5 (28%)	10 (45%)	42 (35%)
7	Bajra	12 (43%)	8 (27%)	7 (32%)	6 (33%)	8 (36%)	41 (34%)
8	Sorghum	11 (39%)	7 (23%)	6 (27%)	5 (28%)	8 (36%)	37 (31%)
9	Potato	3 (11%)	2 (7%)	1 (4%)	2 (11%)	3 (14%)	11 (9%)
10	Onion	2 (7%)	1 (3%)	3 (14%)	1 (6%)	3 (14%)	10 (8%)

Fig. 1. Crops grown by total percentage of farmers

Table 2. Recommended seed rate followed by the farmers in percentage

Sr. No	Seed Rate	Shakrullapur (n=28)	Rora (n=30)	Bibipur (n=22)	Batta (n=18)	Fatehpur-Theri (n=22)	Overall (N=120)
1	Below recommended rate	2 (7%)	3 (10%)	0	2 (11%)	0	7 (6%)
2	Recommended rate	17 (61%)	16 (53%)	12 (55%)	11 (61%)	15 (68%)	71 (59%)
3	Above recommended rate	9 (32%)	11 (37%)	10 (45%)	5 (28%)	7 ((32%)	42 (35%)

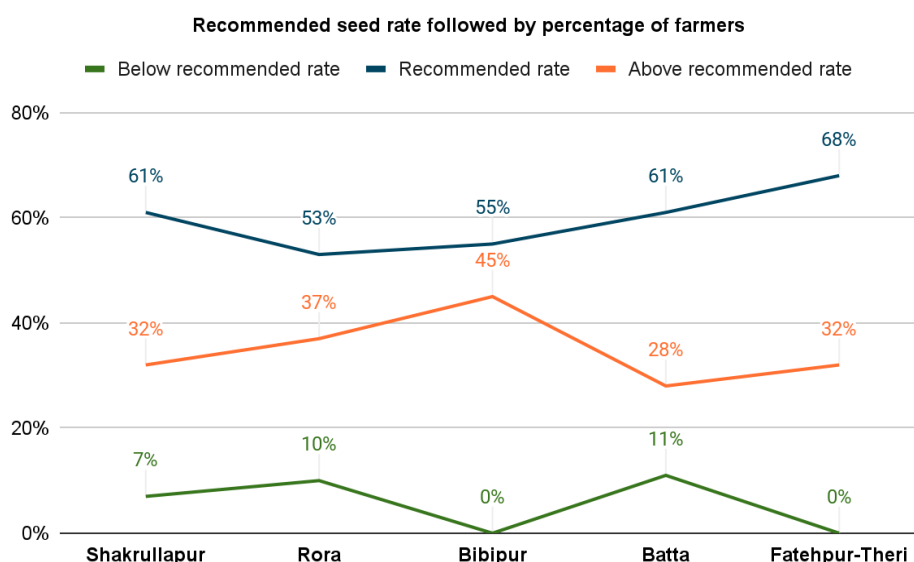**Recommended seed rate followed by percentage of farmers**

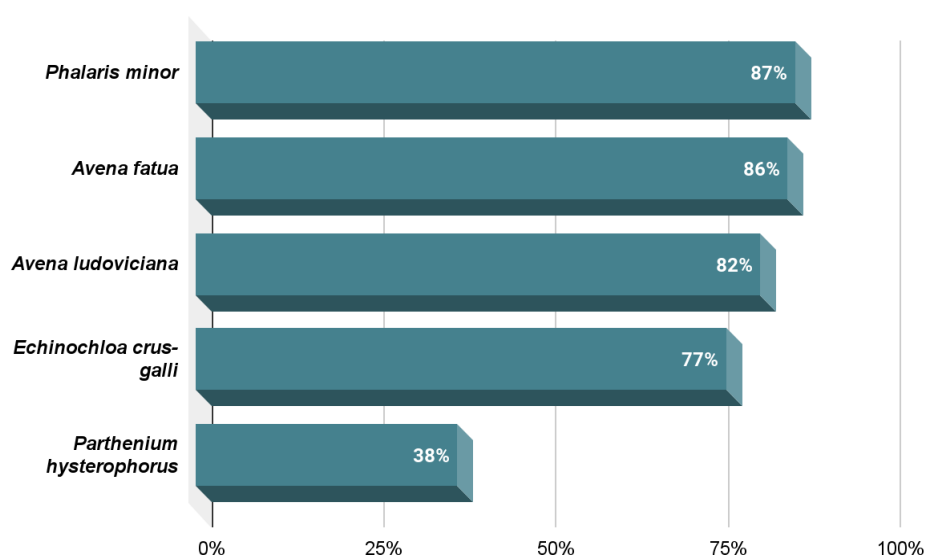**Fig. 2. Recommended seed rate followed by farmers in percentage**

Fig. 3. Percentage of farmers affected by different weeds

3.5 Plant Diseases

According to information acquired from five villages shown in Table 5, around 78% of farmers producing rice reported sheath blight, 63% reported brown leaf spot, and 74% reported dwarf plant diseases in their fields. 71% of farmers producing wheat reported Powdery mildew, 83% reported yellow smut, and 72% reported loose smut disease in their wheat crop. In maize fields 22% of farmers reported Seed rot and 27% reported Sheath blight in their maize crop. Similarly in sugarcane crop, 39% of farmers witnessed red rot disease and 32%of farmers reported smut disease in their fields. In mustard crop, 46% of Farmers reported *Alternaria blight* and 39% farmers witnessed Sclerotinia stem rot in their fields.

Table 3. Represents the mean value of N:P:K amount applied by the respondents

Sr. no	Parameters	Shakrullapur	Rora	Bibipur	Batta	Fatehpur-Theri	Average	Recommended dose/ha
				Wheat				
1	**Urea/ha**	300 kg/ha	340 kg/ha	282 kg/ha	326 kg/ha	293 kg/ha	308.2 kg/ha	120 kg/ha
2	**DAP/ha**	182 Kg/Ha	206 kg/ha	160 kg/ha	175 kg/ha	200 kg/ha	184.6 kg/ha	60 kg/ha
3	**Potassium/ha**	-	-	-	-	-	-	40 kg/ha
				Paddy				
1	**Urea/ha**	150 kg/ha	195 kg/ha	225 kg/ha	186 kg/ha	210 kg/ha	193.2 kg/ha	125 kg/ha
2	**DAP/ha**	373 kg/ha	356 kg/ha	340 kg/ha	330 kg/ha	347 kg/ha	349.2 kg/ha	30 kg/ha
3	**Potassium/ha**	-	-	-	-	-	-	30 kg/ha
				Mustard				
1	**Urea/ha**	195 kg/ha	225 kg/ha	202 kg/ha	190 kg/ha	212 kg/ha	204.8 kg/ha	130 kg/ha
2	**DAP/ha**	254 kg/ha	297 kg/ha	285 kg/ha	260 kg/ha	270 kg/ha	273.2 kg/ha	120 kg/ha
				Sugarcane				
1	**Urea/ha**	540 kg/ha	460 kg/ha	402 kg/ha	512 kg/ha	520 kg/ha	486.8 kg/ha	300 kg/ha
2	**DAP/ha**	267 kg/ha	288 kg/ha	285 kg/ha	300 kg/ha	276 kg/ha	283.2 kg/ha	100 kg/ha
3	**Potassium/ha**	291 kg/ha	321 kg/ha	326 kg/ha	298 kg/ha	310 kg/ha	309.2 kg/ha	200 kg/ha

Table 4. Various crops affected by major weeds

Sr. No	Name of weeds	Crop affected	Shakrullapur (n=28)	Rora (n=30)	Bibipur (n=22)	Batta (n=18)	Fatehpur-Theri (n=22)	Overall (N=120)
1	**Phalaris minor**	Wheat	22 (79%)	28 (93%)	20 (91%)	15 (83%)	20 (91%)	105 (87%)
2	**Avenafatua**	Wheat	22 (79%)	28 (93%)	19 (86%)	15 (83%)	19 (86%)	103 (86%)
3	**Avenaludoviciana**	Wheat	20 (71%)	27 (90%)	18 (82%)	14 (78%)	19 (86%)	98 (82%)
4	**Echinochloa crus-galli**	Paddy	16 (57%)	26 (87%)	19 (86%)	10 (56%)	21 (96%)	92 (77%)
5	**Partheniumhysterophorus**	Sugarcane	11 (39%)	9 (30%)	11 (50%)	5 (28%)	9 (41%)	45 (38%)

Table 5. Represents the data of farmers affected by various crops diseases

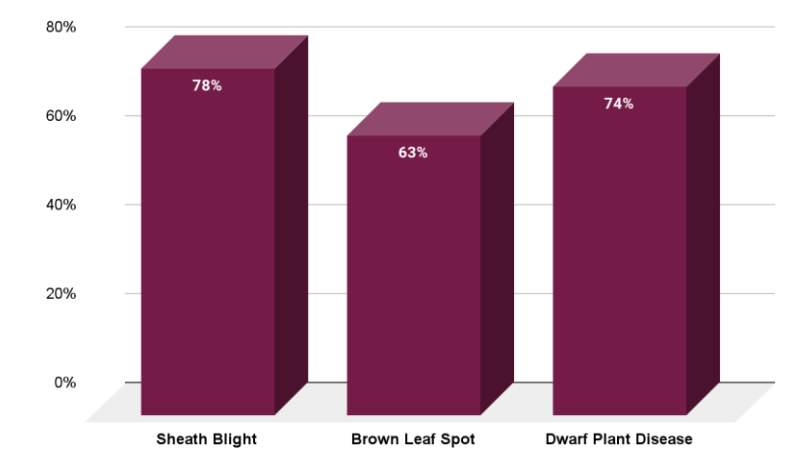| Sr. No.	Crop	Parameters	Shakrullapur (n=28)	Rora (n=30)	Bibipur (n=22)	Batta (n=18)	Fatehpur -Theri (n=22)	Overall (N=120)
1	Rice	Sheath Blight	17 (61%)	25 (83%)	19 (86%)	12 (67%)	20 (91%)	93 (78%)
		Brown leaf spot	12 (43%)	22 (73%)	15 (68%)	8 (44%)	18 (82%)	75 (63%)
		Dwarf plant disease	15 (54%)	24 (80%)	21 (95%)	10 (56%)	19 (86%)	89 (74%)
2	Wheat	Powdery Mildew	20 (71%)	21 (70%)	16 (72%)	12 (67%)	16 (73%)	85 (71%)
		Yellow rust	22 (79%)	27 (90%)	18 (82%)	13 (72%)	20 (91%)	100 (83%)
		Loose smut	21 (75%)	24 (80%)	13 (59%)	10 (56%)	18 (82%)	86 (72%)
3	Maize	Seed rot	9 (32%)	5 (17%)	3 (14%)	2 (11%)	7 (32%)	26 (22%)
		Sheath blight	12 (43%)	6 (20%)	3 (14%)	3 (17%)	8 (36%)	32 (27%)
4	Sugarcane	Red rot	11 (39%)	8 (27%)	12 (55%)	6 (33%)	10 (46%)	47 (39%)
		Smut	9 (32%)	10 (33%)	7 (32%)	4 (22%)	8 (37%)	38 (32%)
5	Mustard	Alternaria blight	11 (39%)	13 (43%)	10 (45%)	6 (33%)	15 (68%)	55 (46%)
		Sclerotinia Stem rot	12 (43%)	9 (30%)	7 (32%)	9 (50%)	10 (45%)	47 (39%)

Fig. 4. Percentage of farmers affected by diseases in rice
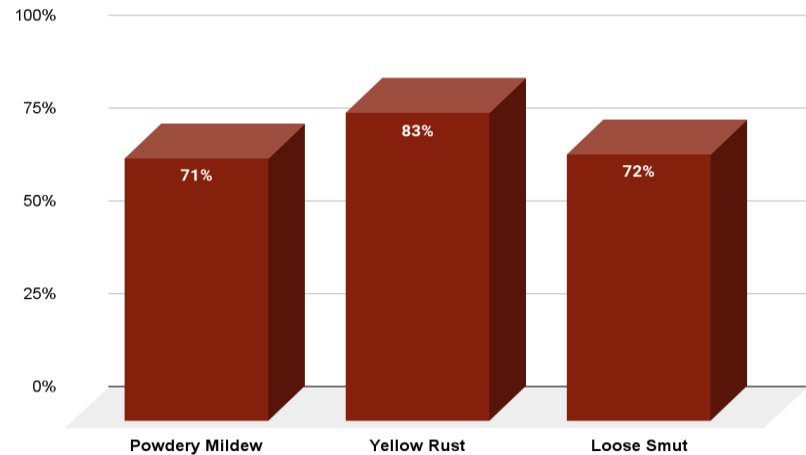

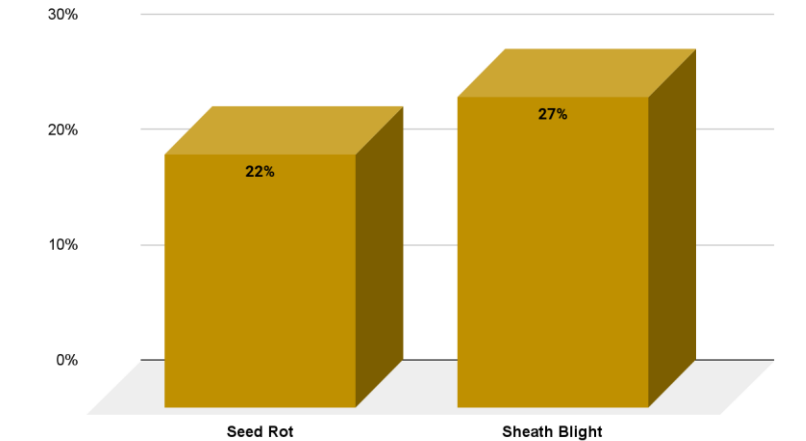**Fig. 5. Percentage of farmers affected by diseases in wheat**

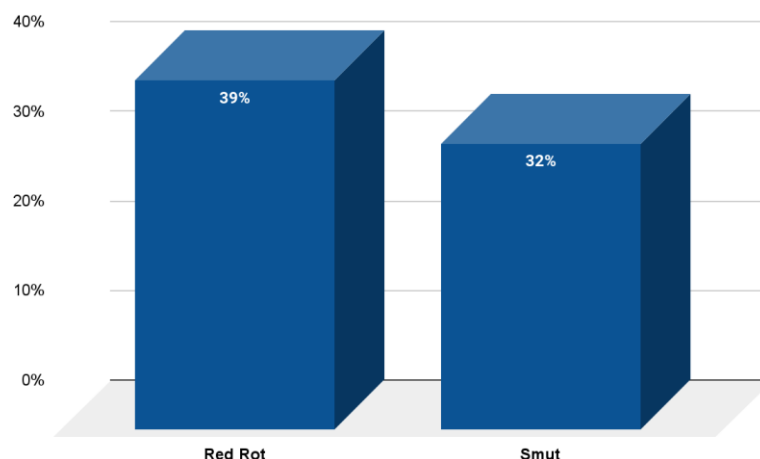**Fig. 6. Percentage of farmers affected by diseases of maize**

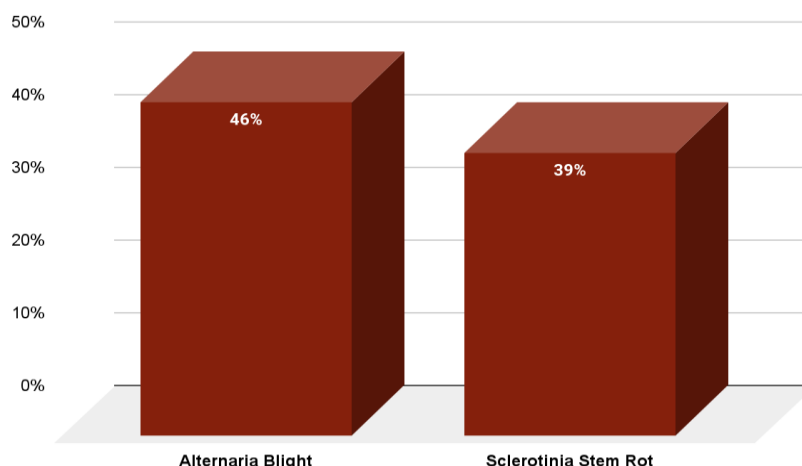**Fig. 7. Percentage of farmers affected by diseases of sugarcane**

Fig. 8. Percentage of farmers affected by diseases of mustard

3.6 Insect and Pest

According to data gathered from 5 villages shown in Table 6, in the paddy crop, roughly 83% of farmers witnessed grasshoppers, 69% of farmers witnessed leaf folders, and 70% of farmers witnessed Rice Hispa in their fields. In fields of wheat crops, 85% of farmers witnessed aphids, while 68% farmers witnessed termites. In fields of maizecrops, 24% of farmers witnessed mites, 26% of farmers witnessed stem borer, and 17% farmers witnessed armyworm in their field. Similarly in sugarcane crop, 38% of farmers witnessed termites in their field, while 41% of farmers observed top borer. In Mustard, 43% of farmers witnessed hairy caterpillars and 45% of farmers reported aphids attack in their fields.

3.7 Harvesting Method

According to the data in Table 7, most farmers prefer using combine harvesters to harvest crops like wheat and rice since it takes less time and effort. Among rice producing farmers combine harvester is used by about 72% of farmers, while 13% prefer hand harvesting. In the wheat crops, combine harvester is used by about 74% of farmers, while 13% prefer manual harvesting. In crops like maize, sugarcane and mustard, farmersare preferring manual harvesting. According to results 50% of farmers' manually harvesting mustard, 44% of farmers' manually harvesting sugarcane and 28% of farmers' manually harvesting maize.

Table 6. Represents the data of farmers affected by different pests infestation

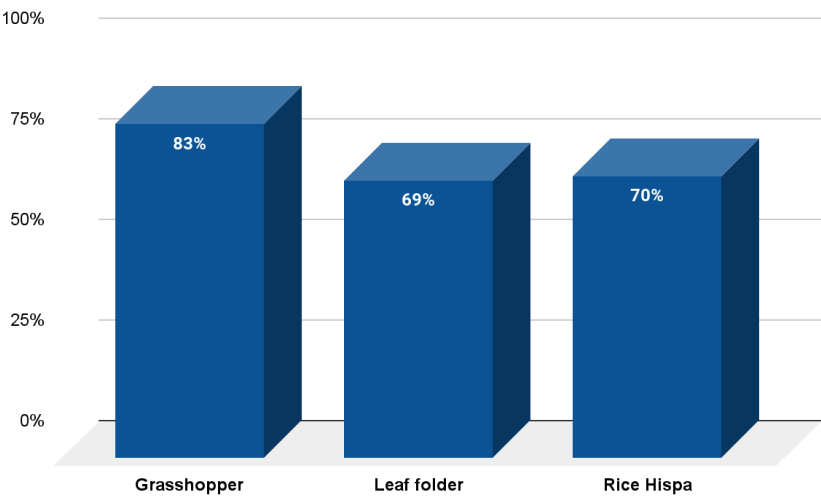| Sr. No.	Crop	Parameters	Shakrullapur (n=28)	Rora (n=30)	Bibipur (n=22)	Batta (n=18)	FatehpurTheri (n=22)	Overall (N=120)
1	Rice	Grasshopper	18 (64%)	28 (93%)	21 (95%)	12 (67%)	20 (91%)	99 (83%)
		Leaf folder	16 (57%)	24 (80%)	17 (77%)	10 (56%)	16 (3%)	83 (69%)
		Rice Hispa	17 (61%)	19 (63%)	15 (68%)	12 (67%)	21 (95%)	84 (70%)
2	Wheat	Aphids	22 (79%)	28 (93%)	17 (77%)	15 (83%)	20 (91%)	102 (85%)
		Termites	19 (68%)	17 (56%)	14 (63%)	13 (72%)	19 (86%)	82 (68%)
3	Maize	Mites	9 (32%)	6 (20%)	3 (14%)	2 (11%)	9 (41%)	29 (24%)
		Stem borer	12 (43%)	5 (17%)	3 (14%)	3 (17%)	8 (36%)	31 (26%)
		Army worm	7 (25%)	6 (20%)	1 (4%)	2 (11%)	4 (18%)	20 (17%)
4	Sugarcane	Top Borer	12 (48%)	9 (30%)	14 (64%)	6 (33%)	8 (36%)	49 (41%)
		Termites	13 (46%)	7 (23%)	11 (50%)	4 (22%)	10 (45%)	45 (38%)
5	Mustard	Aphids	10 (37%)	13 (43%)	10 (45%)	5 (28%)	16 (73%)	54 (45%)
		Hairy Caterpillar	12 (43%)	9 (30%)	8 (36%)	9 (50%)	14 (64%)	52 (43%)

Fig. 9. Percentage of farmers affected by different pests in rice
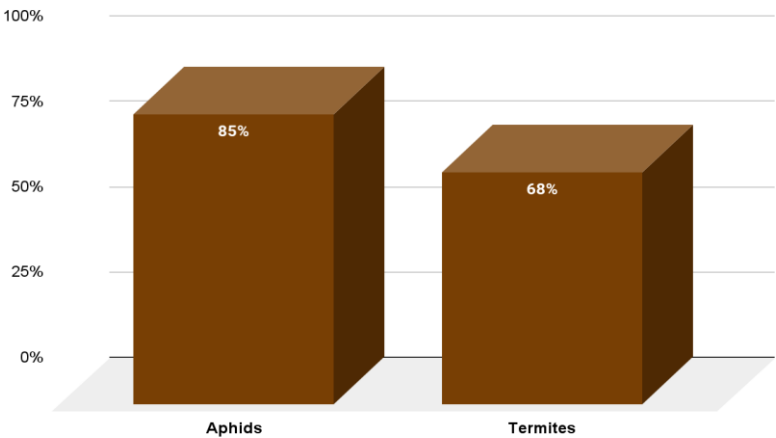

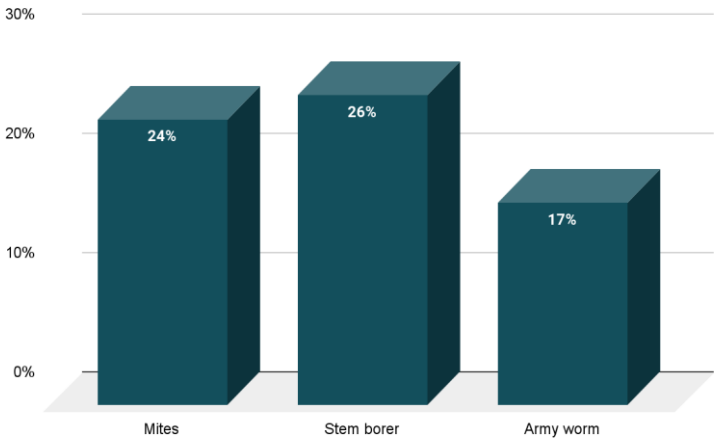**Fig. 10. Percentage of farmers affected by different pests of wheat**

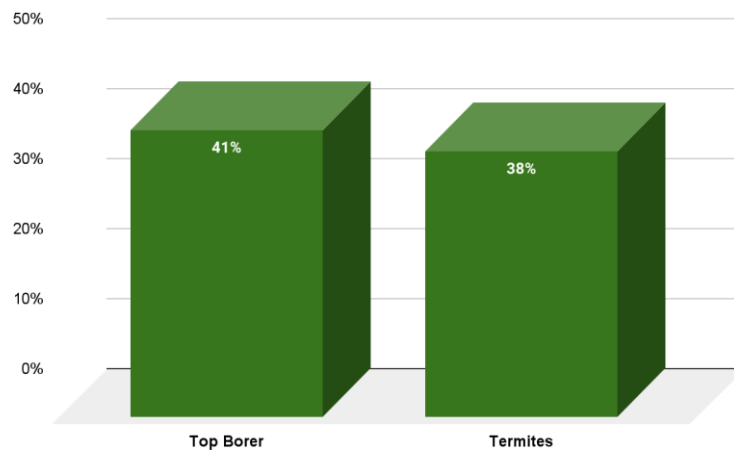**Fig. 11. Percentage of farmers affected by different pests of maize**

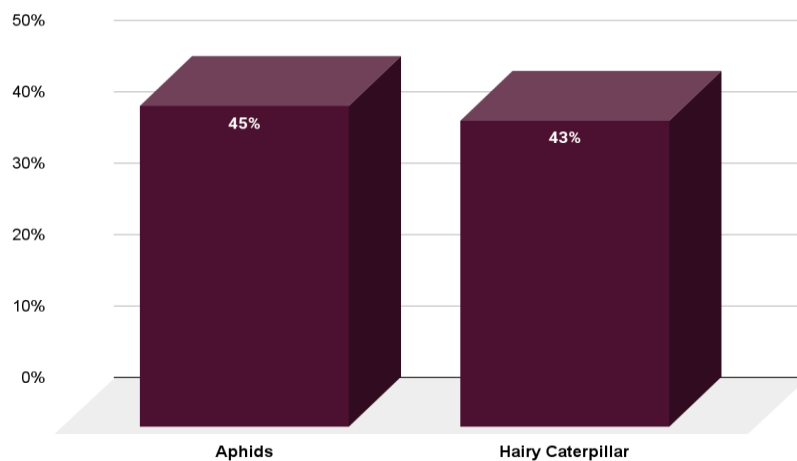**Fig. 12. Percentage of farmers affected by different pests of sugarcane**

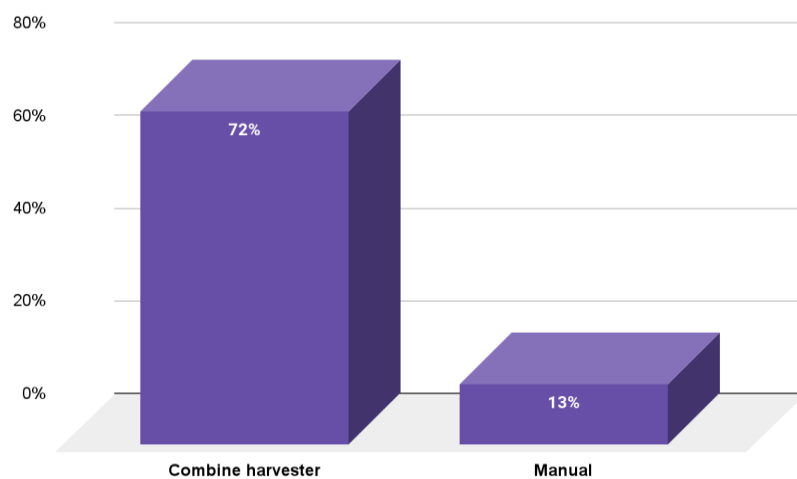**Fig. 13. Percentage of farmers affected by different pests of mustard**

Fig. 14. Percentage of farmers following different harvesting methods in rice

Table 7. Represents the data of farmers following different harvesting methods

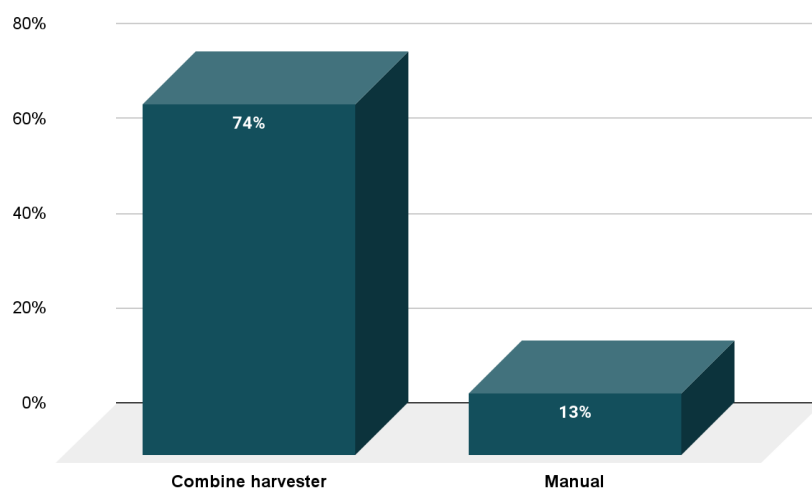| Sr No	Crops	Parameters	Shakrullapur (n=28)	Rora (n=30)	Bibipur (n=22)	Batta (n=18)	FatehpurTheri (n=22)	Overall (N=120)
1	Rice	Combine harvester	12 (43%)	25 (83%)	20 (91%)	8 (44%)	21 (95%)	86 (72%)
		Manual	6 (21%)	3 (10%)	2 (9%)	4 (22%)	1 (5%)	16 (13%)
2	Wheat	Combine harvester	16 (57%)	25 (83%)	18 (82%)	11 (61%)	19 (86%)	89 (74%)
		Manual	6 (21%)	3 (10%)	2 (9%)	4 (22%)	1 (5%)	16 (13%)
3	Maize	Manual	12 (43%)	6 (20%)	3 (14%)	3 (17%)	9 (41%)	33 (28%)
4	Sugarcane	Manual	13 (46%)	10 (33%)	14 (64%)	6 (33%)	10 (45%)	53 (44%)
5	Mustard	Manual	12 (43%)	13 (43%)	10 (45%)	9 (50%)	16 (73%)	60 (50%)

Fig. 15. Percentage of farmers following different harvesting methods in wheat
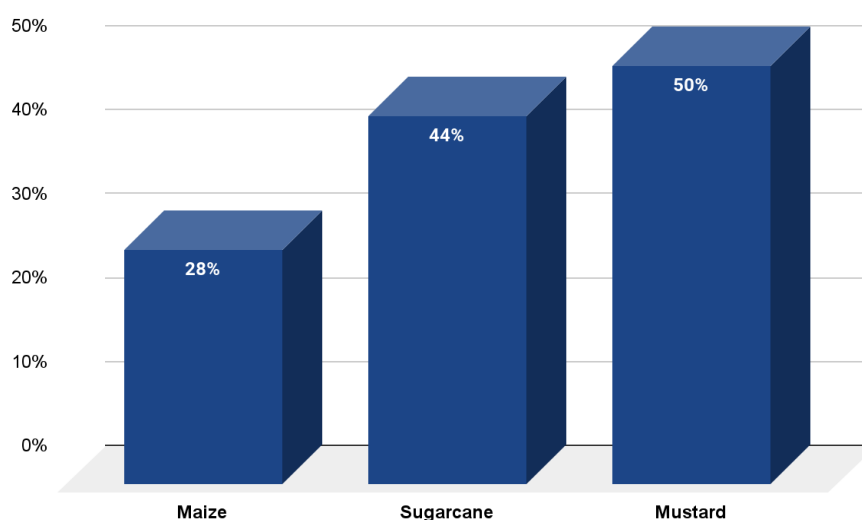

Fig. 16. Percentage of farmers following manual harvesting method in maize, sugarcane and mustard

3.8 Yield Record

As per the Table 8, total average production of rice is 61.4 quintals/ha with highest production of 63 quintals/ha in Bibipur and lowest production of 60 quintals/ha in Rora and Batta. The average production of wheat is 46.6 quintals/ha inRora village having the highest production of 48 quintals/ha and Batta village with lowest production of a 45 quintals/ha. Average production of Maize is 37.8 quintals/ha with lowest production of 37 quintals/ha in Shakrullapur and FatehpurTheri and highest production of 39 quintals/ha in Rora village. Average production of Sugarcane is 810 quintals/ha with lowest production of 790 quintals/ha in Shakrullapur and highest production of 830 quintals/ha in FatehpurTheri village. Similarly Average production of Mustard is 13.6 quintals/ha with lowest production of 12 quintals/ha in Bibipur and highest production of 14 quintals/ha in Shakrullapur.

Table 8. Represents the average yield of major crops grown by the respondents

Sr. No	Crop	Shakrullapur	Rora	Bibipur	Batta	Fatehpur- Theri	Average production
1	Rice	62 quintals/ha	60 quintals/ha	63 quintals/ha	60 quintals/ha	62 quintals/ha	61.4 quintals/ha
2	Wheat	47 quintals/ha	48 quintals/ha	47 quintals/ha	45 quintals/ha	46 quintals/ha	46.6 quintals/ha
3	Maize	37 quintals/ha	39 quintals/ha	38 quintals/ha	38 quintals/ha	37 quintals/ha	37.8 quintals/ha
4	Sugarcane	790 quintals/ha	820 quintals/ha	810 quintals/ha	800 quintals/ha	830 quintals/ha	810 quintals/ha
5	Mustard	14 quintals/ha	15 quintals/ha	12 quintals/ha	13 quintals/ha	14 quintals/ha	13.6 quintals/ha

4. CONCLUSION

Based on these findings, it could be concluded that a variety of crops are grown in this region like Wheat, paddy, sugarcane, maize, mustard, sorghum, berseem, potato, onion etc. Wheat and paddy are the two main cereal crops and mustard is the major oilseed crop cultivated in this area whereas major fodder crop growing is berseem. Majority of the farmers using recommended seed rate. Most of the farmers (87%) facing theproblem of *Phalaris minor*, commonly known as 'Gullidanda' in Punjabi. This was mostly caused by farmers' failure to implement crop rotation in their fields. They are following both manual methods and weedicides to control the weeds. Majority of the farmers observed Sheath blight (78% farmers) in rice and Yellow rust in wheat (83% farmers). To deal with the diseases farmers using different chemicals. Grasshopper and aphids are the major pests causing maximum damage in rice and wheat. Harvesting is mainly done by combine harvester in the case of cereal crops like wheat and rice while maize, mustard, sugarcane, bajra, berseem are harvested manually. Most of the farmers are using excess amount of chemical fertilizers. Farmers are using more complex fertilizers containing nitrogen and phosphorus fertilizers and paying less attention to potassium fertilizers. To solve this issue, farmers should regularly test their soil for macro- and micronutrients to stay informed about the condition of their soil, and they should provide their crops the right amount of nutrients, based on the soil's nutrient status. By using these agronomical techniques, productivity and economic standing can be improved.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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