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Exploring modern and traditional practices adopted by farmers in Rupnagar District, Punjab

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Abstract
About 62% of India's population depends on the agriculture industry for their subsistence, and it contributes roughly 18% of the nation's GDP. Farmers adhere to agronomical standards from seeding to harvesting and storing. The unique farming practices of Punjab's Rupnagar District, known as the "Granary of India," are the focus of this study. We look at the complex interplay between crop productivity and agronomic techniques that will influence the area's agricultural future. This study involves interviewing 90 farmers in six distinct villages to learn more about their farming methods and socioeconomic condition. A questionnaire was created to conduct interviews with farmers. The information gathered from the respondents was sorted and analyzed using the proper statistical techniques. Seed rate, fertilizer application, seed treatment, major weeds infesting the fields, major pests attacking crops, major diseases infesting the fields, and crop yield range were among the issues covered by the information collected from the respondents.

Keywords: Agronomic practices, average, production, farmer, agriculture

Introduction
Agriculture is considered as the backbone of a country's economy. It plays a vital role in supporting livelihood of billions of people of India. It contributes about 20% to the GDP of our country [1]. About 55% population of India relies on agriculture for their livelihood [2] and about 70% rural population relies on agriculture for their survival [3]. India has the second-largest agricultural land area in the world, and about half of its people are employed in the agriculture sector [2]. It is the primary source of generating food, income and improving social status of farmers. It also plays a crucial role in improving food security around the world. Agriculture includes a broad range of operations, from raising cattle to growing crops, and it is impacted by variables including global trade dynamics, technology breakthroughs, and climate change. Historically, agriculture was solely done for domestic use. However, as time went on, advances in agronomic techniques and new technology were produced to increase crop productivity, and people began to make a living from it as well. However, a number of challenges also surfaced in the socioeconomic domains in addition to the environmental risks [4]. With the advances in technology, Agriculture has evolved with better agronomic practices for crop production. These agronomic activities refer to all the activities and practices from sowing of seed to the harvesting of the crop. The crop's yield is directly correlated with agronomic methods. Farmers must use the finest agronomical procedures according to the season and agro climatic zone in order to produce a good output [3]. Punjab is the best example for using agronomic activities for producing high and a quality output.
During the height of the Green Revolution, Punjab's agricultural output was exceptional. From 1971–72 to 1985–86, its agriculture GDP rose at a pace of 5.7% year, more than doubling the 2.31 percent growth rate attained for the entire country during that time. This outstanding performance by Punjab, initially seen in massive wheat surpluses and later in rice allowed India to exit the PL 480 food aid program. Thus, India gained much-needed food security as Punjab came to represent the country's grain surpluses [5].
Punjab has been divided into 5 agroclimatic zones based on factors including farming patterns, rainfall patterns, and homogeneity.

These are the sub-mountain zones which includes undulating plain zone, central plain, and undulating zone, western zone, and western plain zone [6]. Rupnagar district of Punjab is part of the Agro-climatic zone 1 and 2 (Undulating zone) of the state. It is a part of the Kandi belt of the Himalayas and the alluvial plain of the Sutlej River. The climate of this region is characterized by hot summers, cold winters and a general dryness. The average annual rainfall is 1000 mm, with about 78% falling between June and September. The soil of the district varies in texture generally from loam to silty clay loam. Wheat, Paddy, Maize, Sugarcane, Jowar, bajra and oilseeds are suitable for growing in this soil [7]. So, the farmers of the region follow common agronomic practices for crop production.

Materials and Methods

The study was conducted in Morinda block of Rupnagar district of Punjab. Five villages were selected randomly (Dhianpur, Kakrali, Dhangrali, Khairpura and Dhanauri).A total of 90 farmers were selected on a random basis for the interview. A total of 15respondents were selected from village Dhiapura, 22 from Kakrali, and 18 respondents from village Dhangrali, 12 respondents from Khairpura and 23 respondents from Dhanauri. 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 questionnaire was created in order to interview the farmers and thoroughly examine each parameter in order to cover every part of the agronomical techniques that the farmers used.

Following the gathering of data from respondents, appropriate statistical measures, including percentages, graphical representation, bar graphs, and pie charts, were used to classify and analyse the data.

Results and Discussion

Major crops cultivated by farmers in kharif and rabi seasons

The data gathered indicates that nearly all of the respondents-nearly 100%-cultivate rice crops on their farms, and that every farmer in the study area grows wheat. Apart from these two crops around 54% of farmers grow sugarcane crop in their fields overall 42% of farmers cultivate the Maize crop. Moreover 41% of the farmers grow the Mustard.

Table 1: Crops cultivated all year round in Rupnagar district

Crop	Dhainpura	Kakrali	Dhangrali	Khair pur	Dhanauri	Overall%
Wheat	15	22	18	12	23	90 (100%)
Rice	15	22	18	12	23	90 (100%)
Sugarcane	9	12	11	7	10	49 (54%)
Barseem	7	9	12	11	15	54 (60%)
Maize	5	8	10	7	8	38 (42%)
mustard	3	7	9	10	8	37 (41%)

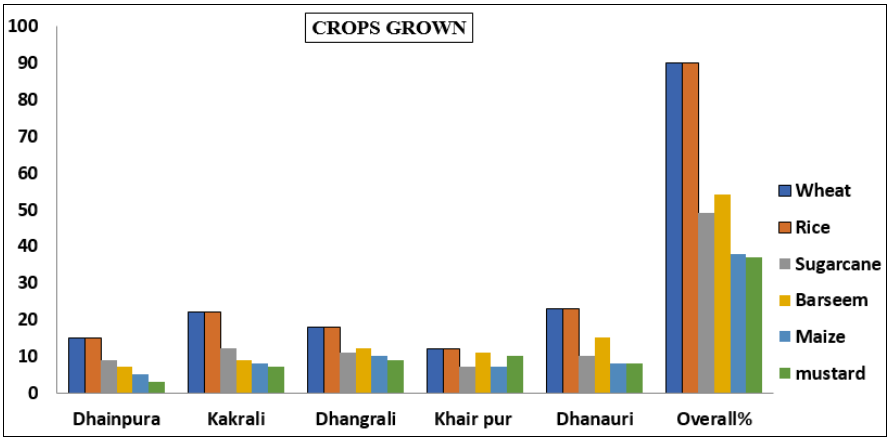

Fig 1: Depicts the crop distribution of various crops grown by the respondents

Seed Rate

It is seen in the study that most of the farmers in the selected villages follow the recommended seed rate of PAU for wheat crop. Only 4% farmer's use above the recommendation for seed sowing. While for the Paddy it varies. Some farmers use above the recommended seed rate and some use below recommended seed rate whereas some stick to the recommended seed rate of PAU for paddy sowing.

Out of 15 respondents of Dhianpur, 6 uses seeds above the recommendation, 2 uses seeds below the recommendation while 7uses the recommended seed rate for paddy. Out of 22 respondents of village Kakrali, 12 use recommended seed rate, 8 use above the recommended seed rate, 2 use below the recommended seed rate. Out of 18 respondents of village Dhangrali, 10 uses the recommended rate, 7 uses above the recommended seed rate and 1 uses below the recommended seed rate. Similarly, in the village Khairpura, Out of 12 respondents, 5 use recommended seed rate, 4 use above the recommended seed rate and 3 use below the recommended seed rate. In the same way, in the village of Dhanauri, out of 23 respondents, 12 use recommended seed rate, 7 use above the recommended seed rate and 4 use below the recommended seed rate.

Table 2: Seed rate adopted by 90 farmers for Paddy

Village	No. of farmers using recommended seed rate	No. of farmers using above the recommended seed rate	No. of farmers using below the recommended seed rate
Dhianpur	7	6	2
Kakrali	12	8	2
Dhangrali	10	7	1
Khairpura	5	4	3
Dhanauri	12	7	4
Total	46	32	12

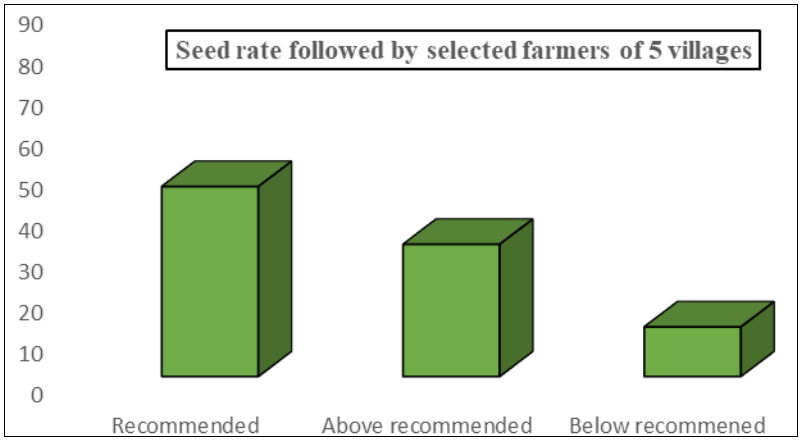

Fig 2: Seed rate of paddy followed by 90 farmers of selected five villages

Seed treatment

In the study, it is observed that most of the farmers use already treated seeds and while others use chemical treatment by soaking seeds into fungicides by themselves. On the other hand a very few of the respondents treat seeds organically.

Table 3: Seed treatment followed by selected farmers

Village	Farmers using already treated seeds	Farmers using chemical seed treatment	Farmers using organic treatment
Dhianpur	11	4	-
Kakrali	16	5	1
Dhangrali	13	5	-
Khairpura	10	2	-
Dhanauri	19	3	1
Total	69	19	2

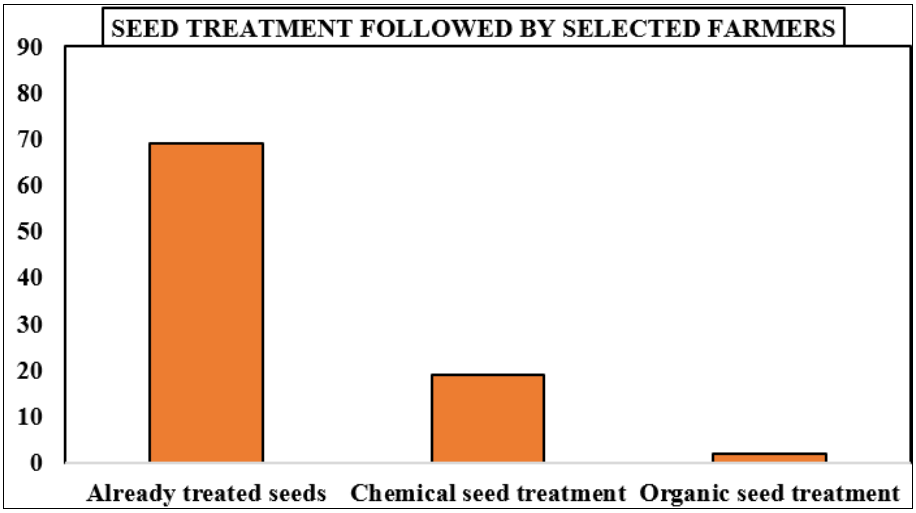

Fig 3: Represents the seed treatment adopted by farmers of selected villages

Irrigation System

In the context of irrigation systems in the Rupnagar District, the study focuses on two important crops: rice and wheat. The primary irrigation methods utilized in rice growing are flood irrigation and tube wells. Farmers in the region use regular and consistent irrigation schedules to maintain the optimal moisture levels in the rice fields. Furthermore, water management techniques are required at this the first planting coincides with the crucial period for rice irrigation. The primary irrigation source for wheat farming is still tube wells. When growing wheat, farmers irrigate it four to five times, focusing especially on the developmental stage that starts to show between 20 and 21 days after sowing (DAS). In addition to meeting the crop's developmental needs, this particular irrigation strategy demonstrates a thorough understanding of water management strategies in wheat cultivation.

Table 4: Irrigation methods for main cereal crops done by farmers

Crop	Method of irrigation	No. of irrigation	Stage / DAS
Paddy	Tubewell	6 to 25 times (Regular)	At the interval of 20 DAS
Wheat	Tubewell	4-6 times	20-21DAS

Nutrient Management

The table (5) represents the data of dose of urea applied according to recommendation, above recommendation and below recommended level. 22% farmers use recommended dose of urea, 9% use below recommended dose of urea and 69% use above recommended dose of urea

Table 5: Dose of urea applied

Sr. No.	Urea	Dhainpura	Kakrali	Dhangrali	Khairpur	Dhanauri	Overall%
1	Recommended	14%	33%	0%	38%	28%	22%
2	Below Recommended	14%	0%	0%	12%	16%	9%
3	Above Recommended	72%	67%	100%	50%	56%	69%

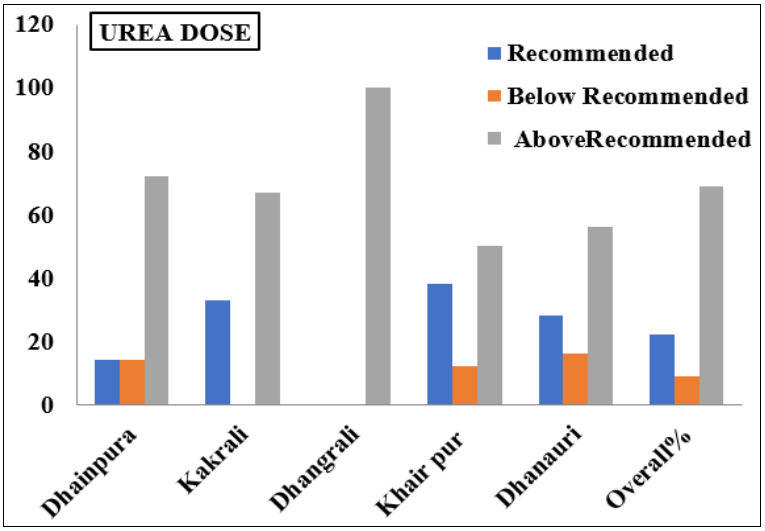

Fig 4: Dose of urea applied

Dose of DAP

The table (6) represents the data of dose of DAP applied according to recommendation, above recommendation and below recommended level. 34% farmers use Recommended dose of DAP, 16% use below recommended dose of DAP and 50% use above recommended dose of DAP.

Table 6: Dose of DAP applied

Sr. No.	DAP	Dhainpura	Kakrali	Dhangrali	Khair pur	Dhanauri	Overall%
1	Recommended	43	45	25	26	33	34%
2	Below Recommended	0	23	0	35	25	16%
3	Above Recommended	57	34	75	39	42	50%

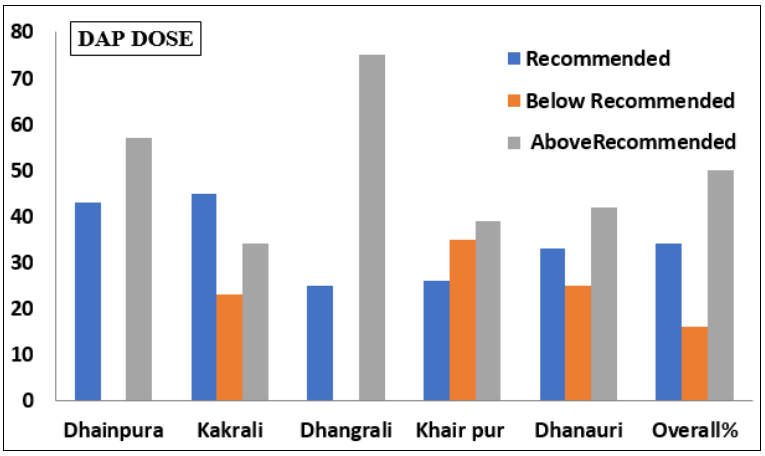

Fig 5: Dose of DAP applied

Dose of MOP: The table (7) represents the data of dose of MOP applied according to recommendation, above recommendation and below recommended level. 30% farmers use recommended dose of MOP, 70% use below recommended dose of MOP.

Table 7: Dose of MOP applied

Sr. No.	MOP	Dhainpura	Kakrali	Dhangrali	Khair pur	Dhanauri	Overall %
1	Recommended	28	34	25	38	23	30
2	Below Recommended	72	66	75	62	77	70

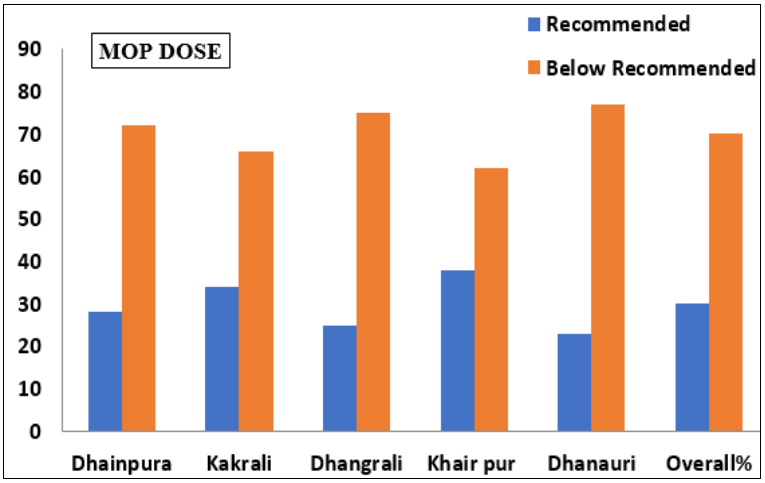

Fig 6: Dose of MOP applied

Weed challenges across crops

A detailed examination of the problems associated with weeds identifies a persistent problem that affects Rupnagar District agricultural output. Although farmers deal with a variety of crop-specific weeds throughout the year, Phalaris minor is the most prevalent weed, according to a noteworthy 100% of respondents. The tolerance of Phalaris minor to conventional herbicides is a cause for concern, particularly during the Rabi season when crop yields are drastically reduced.

Approximately 88% of respondents reported that the swank weed (Echinochloa crus-galli) had a widespread impact on the production of rice during the Kharif season. As another prominent weed problem in paddy agriculture, 83% of respondents identified Cyperus rotundus. 61% of respondents said that Avena ludoviciana presents a serious weed problem for wheat agriculture. These results highlight how urgent it is to put into practice efficient weed control techniques, particularly when dealing with herbicide-resistant weeds like Phalaris minor. Since these weeds are so common, crop yields are directly in danger, emphasizing the need for focused interventions and education campaigns to lessen the negative effects of weeds on the region's agricultural output.

Table 8: Types of weeds that pose a challenge to farmers

Sr. No.	Weed Name	Crop	No. of Farmers (Overall Percentage)
1	Echinochloa crus-galli	Paddy	80 (88%)
2	Cyperus rotundus	Paddy	75 (83%)
3	Phalaris minor	Wheat	90 (100%)
4	Avena ludoviciana	Wheat	55(61%)

Plant Diseases: The table (9) represents the plants disease which are observed by the farmers in the surveyed villages

Table 9: Depicts the diseases observed by respondents

Sr. No	Parameter	Crop	Dhainpura No. of farmers (%)	Kakrali No. of farmers (%)	Dhangrali No. of farmers (%)	Khair pur No. of farmers (%)	Dhanauri No. of farmers (%)	Overall%
1	Sheath blight	Paddy	12 (80%)	18(81%)	11 (61%)	8 (66%)	17 (73%)	72%
2	Dwarf Plant disease	Paddy	4 (26%)	13 (59%)	5 (27%)	4 (33%)	7 (30%)	35%
3	Yellow rust	Wheat	14 (93%)	20 (90%)	13 (72%)	9 (75%)	19 (82%)	82%
4	Loose smut	Wheat	11 (73%)	15 (68%)	10 (55%)	9 (75%)	15 (65%)	67%

Insect/ pests: The table (10) represents the pest which are observed by the farmers in the surveyed villages

Table 10: Depicts the major insects and pests observed by respondents

Sr. No	Parameter	Crop	Dhainpura No. of farmers (%)	Kakrali No. of farmers (%)	Dhangrali No. of farmers (%)	Khair pur No. of farmers (%)	Dhanauri No. of farmers (%)	Overall %
1	Grasshopper	Paddy	9 (60%)	16 (72%)	13 (72%)	10 (83%)	18 (78%)	73%
2	Leaf folder	Paddy	7 (46%)	13 (59%)	10 (55%)	6 (50%)	13 (56%)	53%
3	Aphids	Wheat	11 (73%)	18 (81%)	12 (66%)	9 (75%)	19 (82%)	75%
4	Bettle	Wheat	8 (53%)	15 (68%)	9 (50%)	6 (50%)	15 (65%)	57%

Yield record of the respondent farmers

As per the table, (Table 11) average yield of the wheat crop is around 32 QTLs per hectare, Village Dhangrali has the highest productivity (55 QTLs) in the case of wheat crop whereas village Kalewal has the lowest productivity (35 QTLs) rate in wheat crop. But village Dhainpura has the highest productivity of paddy crop and village Khair pur has the least productivity rate (20 QTLs) and overall production is about 22.6QTLs/ha. The average production of Mustard is 13.4 QTLs/ha and village Kakrali has the highest productivity (15 QTLs).

Table 11: Depicts the Yield of the major crops grown by the respondents

Sr. No	Crops	Dhainpura	Kakrali	Dhangrali	Khair pur	Dhanauri	Overall%
1	Wheat	30qtls/ha	33qtls/ha	35qtls/ha	32qtls/ha	30qtls/ha	32qtls/ha
2	Paddy	25qtls/ha	22qtls/ha	21qtls/ha	20qtls/ha	22qtls/ha	22.6qtls/ha
3	Mustard	12qtls/ha	15qtls/ha	14qtls/ha	13qtls/ha	13.4qtls/ha	13.4qtls/ha

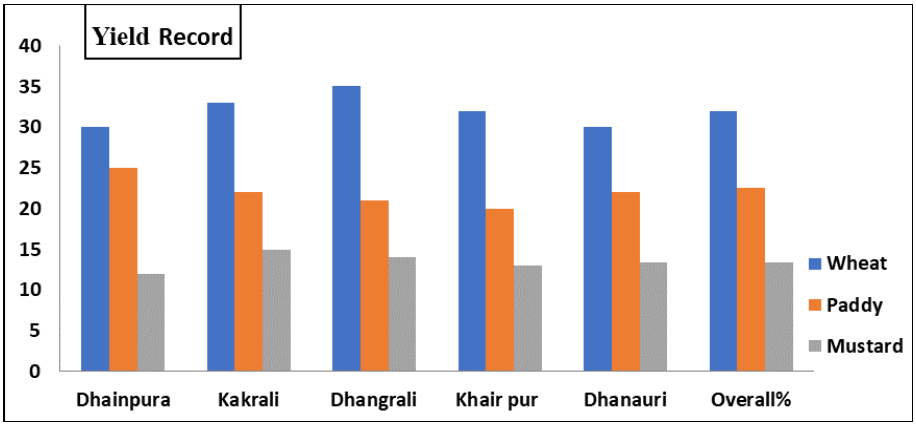

Fig 7: Represents the data regarding Yield of the crops

Methods of Harvesting

The data collected indicates that farmers typically favor the use of combine harvesters for harvesting cereal crops, such as paddy and wheat. Because combine harvesters are efficient and don't require a lot of physical labour, this option was made. It's interesting to note that while roughly 83% of respondents stated they preferred combine harvesters for some grain crops, only 17% stated they preferred hand harvesting.

Farmers opt for the meticulous process of harvesting to maintain grain quality, as they understand that mechanized harvesting can potentially damage the grains. This understanding of harvesting methods highlights the growing reliance on combine harvesters for greater efficiency. It also underscores the thoughtful decision-making involved in choosing manual harvesting for crops with unique grain characteristics. These factors align with the broader goal of optimizing farming practices to maintain quality and maximize yield.

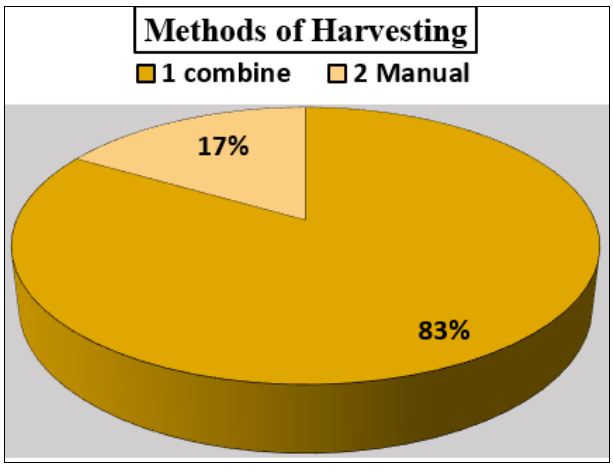

Fig 8: Pie chart which shows percentage share of different harvesting methods

Conclusion

As we wrap up this investigation into the agricultural practices of Rupnagar District, we see a vibrant fusion of conventional and contemporary agronomic methods that sustain a variety of crops and highlight the area's agricultural resilience. Given their importance to the local economy, wheat and paddy are the most common crops grown by 100% of the farmers surveyed. Furthermore, a diverse cropping pattern that supports food security and income stability in the district is demonstrated by the fact that 42% of farmers grow maize, 41% produce mustard, and 54% grow sugarcane. Although there are variances, a sizable percentage of farmers adhere to institutional recommendations regarding seed rates. 51% of farmers apply the prescribed seed rate for paddy, 36% go over it, and 13% go below it. About 96% of wheat farmers follow the PAU's suggested seed rate, indicating a better level of adherence to its instructions. However, some overuse tendencies are revealed by nutrient management approaches. Just 22% of farmers use urea within specified limits, whereas the vast majority-69%-apply it over permissible levels. According to DAP application data, 34% of farmers follow recommendations, while 50% apply above suggested rates. MOP use is lower, with only 30% adhering to recommendations and 70% applying it below, indicating variations in fertilizer usage practices.

Another area of difficulty is weed management. 100% of responders mentioned Phalaris minor, a major weed that affects wheat, indicating how common it is and how resistant it is to conventional pesticides. Echinochloa crus-galli (88%) and Cyperus rotundus (83%) are the two most common weeds that affect rice yield during the Kharif season, underscoring the necessity of coordinated weed control methods. Irrigation also uses a lot of water, especially when growing rice, where tube wells and flood irrigation are utilized up to 25 times a season. Irrigation of wheat is highly regulated; farmers usually water it four to six times, particularly twenty days after sowing. Given Punjab's diminishing groundwater levels, this dependence on intensive irrigation highlights the necessity of sustainable water management techniques. Harvesting methods provide as another example of the trend toward mechanization. 83% of farmers prefer combine harvesters, although 17% still harvest their crops by hand, especially for crops where grain quality is important.

Overall, this study highlights that although Rupnagar farmers use a variety of efficient agronomic techniques, specific assistance is needed to address issues with water consumption, weed resistance, and nutrient management. Resolving these problems will improve sustainability and production, putting Rupnagar in a position to continue playing a significant role in India's agriculture industry.

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