Original Research Article

Assessing Agricultural Practices and Plant protection methods in Rupnagar District, Punjab, India

ABSTRACT

Aims: The purpose of this research is to analyze plant protection systems and agricultural practices in Punjab, India's Rupnagar District, in order to provide insights into nutrient management, seed rates, crop diversity, mechanization, and their implications.

Study design: A mixed-methods methodology is used in the study design. It combines field surveys, interviews, and data analysis to extensively analyze agricultural practices in Rupnagar District, Punjab, India, including crop diversification, mechanization, and the use of plant protection strategies.

Place and Duration of Study: Villages of Rupnagar district, Punjab (Primary place) and Department of Agriculture sciences, Chandigarh university, Gharuan(Secondary place), between August 2023 and September 2023

Methodology: As part of the research approach, 120 farmers from six different villages in the Rupnagar district took part in field trips and structured interviews. Crop varieties, seed rates, equipment ownership, and nutrient management approaches were among the agricultural issues covered throughout the information gathering. Random sampling ensured representativeness. The study's goal was to learn more about regional farming practices and their effects**.**

Results: According to the data, the two main crops grown in the research areas were rice and wheat. Among the various degrees of mechanization observed, tractors were the most frequently visible piece of equipment. Seed rate management varied, and some farmers used more seed than was recommended.

The data revealed a diversity of nutrient management approaches, as well as a proclivity for urea overuse. These findings offer insight on how complex the farming methods in the area are.

Conclusion: The study emphasizes the significance of improved mechanization, crop diversity, and sustainable farming techniques in Rupnagar, Punjab, to promote future agricultural development.

Keywords:*Agricultural Practices, Crop Diversity, Mechanization, Seed Rate, Nutrient Management*

1. INTRODUCTION

Agriculture, often referred to as the backbone of many economies, plays a pivotal role in ensuring food security, economic prosperity, and the overall well-being of nations [3].This agricultural prowess extends well beyond state borders, as India itself stands as one of the world's major agricultural hubs, supplying a diverse range of crops to the global market [1]. Agriculture's profound implications are further underscored when considering its vital role in addressing the increasing challenges of a growing global population[3]. This significance is particularly exemplified in the context of Punjab, a northern state of India. Known as the "Granary of India," Punjab's agriculture sector has been instrumental in not only providing sustenance to its population but also contributing substantially to the nation's grain reserves [2,5].

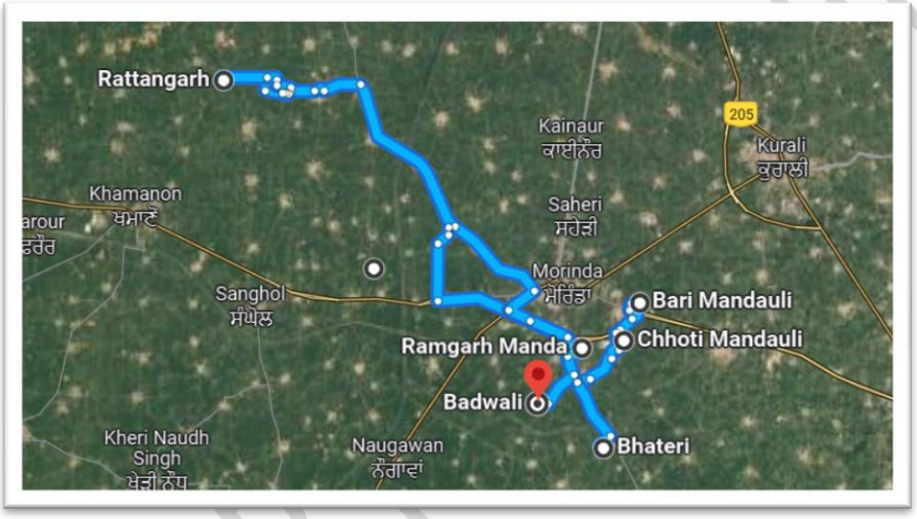
Agriculture that can regularly feed food and other resources to a growing global population is critical to human survival and, by extension, to all human undertakings. Climate change, a high rate of biodiversity loss, land degradation due to compaction, erosion, pollution, and salinization, depletion and pollution of water resources, rising production costs, a steadily declining number of farms, and the poverty and declining rural population that accompany it all pose a threat to agriculture's ability to meet human needs now and in the future [11].

In the ever-evolving landscape of agricultural education, a transformative program known as the Rural Agricultural Work Experience (RAWE) program has taken root in agricultural universities across India [4]. Objectives of this research are to characterize the agricultural practices followed by farmers and to

analyze the data to identify any emerging trends, patterns, or commonalities among different agricultural practices.

2. MATERIAL AND METHODS

The study was conducted in six villages: Mandaulikhurad (District Rupnagar), Ratangarh (District Rupnagar), Ramgarh manda (District Rupnagar), Badwali (District Rupnagar), Bhateri (District Fategarh sahib), and Mandaulikalan (District Rupnagar).



Picture 1 :Map showing study location

This survey's data was gathered through a combination of field trips and farmer interviews. In their capacity as surveyors, members visited the selected farms and conducted formal interviews with the participating farmers. Researchers used a standardized questionnaire to collect information on crop types, varieties, acreage, seed rates, suggested seeds, irrigation techniques, seed and fertilizer usage, cultivation techniques, disease management strategies, years of farming experience, and changes in farming practices over time.

Among the principal data collection sources were:

1. Direct Interviews: Researchers asked questions of the farmers face-to-face and noted their answers.

2. On-site observations were conducted by the researchers regarding farming techniques, including the availability of agricultural machinery and the state of the crops.

3. Historical Records: A question concerning years of experience and past modifications to farming methods was posed to farmers.

Random sampling is used in surveys. In random sampling, a portion of the population (farmers in this case) is chosen at random, offering each person an equal chance of being included in the sample. To assure representativeness, this technique is frequently applied [12].

A total of 120 farmers were surveyed and data were collected. From Mandaulikhurad, 15 respondents were interviewed, from Ratangarh, 20 respondents were interviewed and from Ramgarh manda, Badwali, Bhateri and Mandaulikalan, 25,15, 25, 25 respondents were interviewed respectively. During the survey conducted, the major crops were Rice, Wheat, Barseem (fodder) and Multi-cut sorghum (fodder) whereas other crops which are grown by less farmers were vegetables and sugarcane.

3. RESULT AND DISCUSSION

Farmers have begun to use increasing dosages of chemical fertilizers and other agro-chemicals in order to sustain current levels of food grain output, which has impacted the ecology. As a result, farmers must be educated about the importance of sustainable agriculture, the financial benefits of conservation technology and practices to both the state and farmers, and the need for them to demonstrate these techniques on their farms in order to preserve Punjabi agriculture. To compete on the market with rice wheat systems, government policies must be amended to encourage natural resource management and environmental conservation. Maize, pulses, oilseeds, milk, and other products also require assistance, as does the building of supply and value chain systems for these items. [5].

There are various research options available to increase crop yields. There are numerous options for rice, Punjab's main crop: improved rice cultivars, optimal pesticide use, the use of laser leveling and furrow irrigated raised beds (FIRB) technologies, the matching of water availability with land use systems, the adoption of practices free of distortion, integrated crop management, strengthened crop improvement programs, integrated pest and disease management, integrated nutrient management, site-specific nutrient management (SSNM). [10].

3.1. MAJOR CROPS GROWN

In six communities, local farmers raise a diverse range of crops. According to statistics (Table 1), these groups follow various agricultural patterns. Wheat and rice are the most common crops in MandauliKhurad, with notable occurrences of multi-cut sorghum, barseem, and mustard. Maize and sugarcane are minor crops. Wheat and rice are the principal crops of Ratangarh, with mustard accounting for a significant percentage and other crops being considered. Ramgarh Manda is known for its emphasis on barseem, wheat, and multi-cut sorghum, rather than sugarcane. Badwali, like MandauliKhurad, grows a variety of crops, although maize and cauliflower are becoming increasingly popular. These variations reflect the diverse agricultural methods utilized in these societies.

Table. 1. Crops grown by farmersin different villages of Rupnagar district

	Crops grown (% of total farmers)								
Village name	**Rice**	**Wheat**	**Multi-cut sorghum**	**Barseem**	**mustard**	**Sugarcane**	**Maize**	**Cauli-flower**	**Other crops**
MandauliKhurad	100	100	93.3	86.7	40	6.7	6.7	13.3	0
Ratangarh	100	100	90	85	75	15	20	0	10
Ramgarh Manda	92	100	96	96	60	0	0	4	0
Badwali	100	100	93.3	86.7	60	20	26.7	6.7	13.4
Bhateri	92	100	96	92	44	4	12	12	0
Mandaulikalan	100	100	92	76	56	0	8	0	0
Total	**97.3**	**100**	**93.4**	**87.06**	**55.8**	**7.61**	**12.2**	**6**	**3.9**

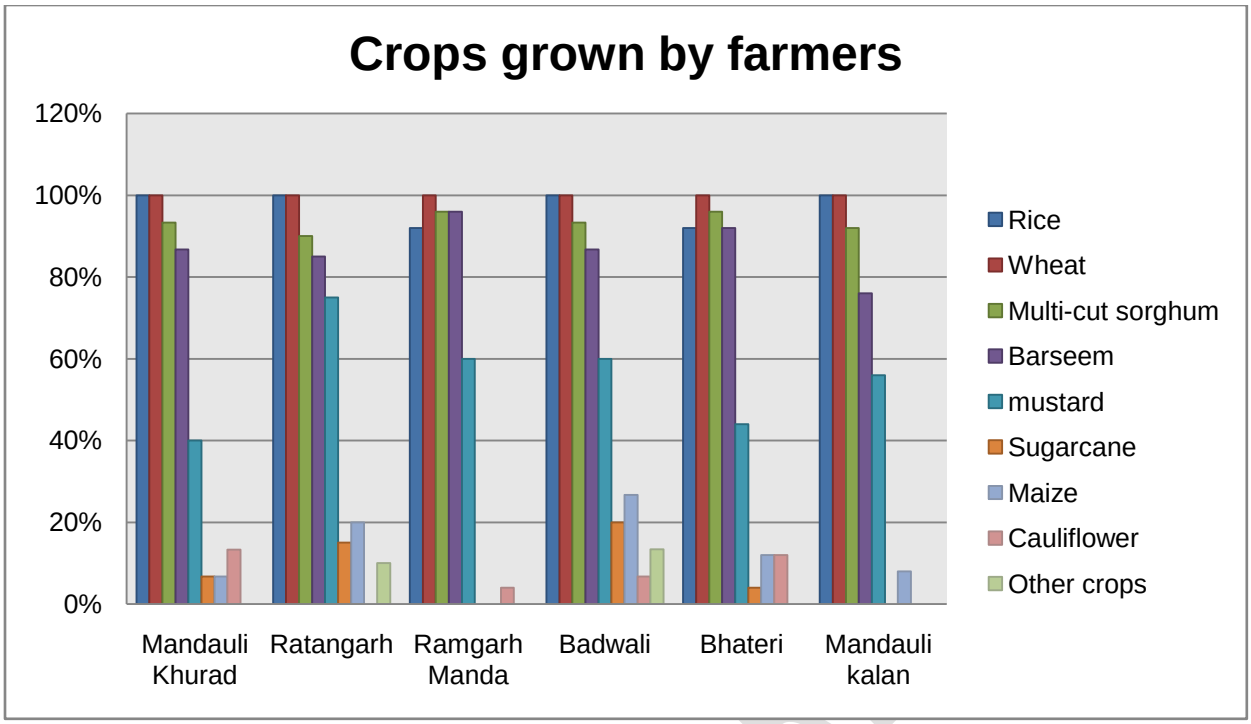


Fig.1. Crops grown by farmers

The data depicts crop distribution across multiple villages. Wheat is grown in every village, although the majority also grows multi-cut sorghum and rice as their principal crops. Mustard and sugarcane are not evenly distributed. Maize and cauliflower are rather uncommon. Rice, wheat, and multi-cut sorghum are the principal crops in each village, with varying proportions of other crops.

3.2. COMMONLY GROWN VARIETIES

In the Rupnagar district, there are six unique villages that farm a varied range of common crop species. Farmers in these villages have adopted a range of crop types to accommodate their distinct preferences and local conditions. Wheat fields, in particular, prosper with WH 711, DBW 17, and PBW 502, while rice varieties such as Pusa 44, HKR-47, and others are popular. For fodder, Barseem varieties BL42 and BL10 are preferred; for multi-cut sorghum, SL44, Punjab Sudax, and Chari 1 are offered. GSC6 and GSC5 are shown in mustard fields, whilst TL 15 (toria), Hyola and Hybrid Shell, Double, 31Y45 are shown in sugarcane and maize fields, respectively. These various varieties reflect the area's extensive agricultural past (Table 2).

Table. 2. Common varieties grown by farmers in Villages of Rupnagar district

Crop name	Varieties grown
Rice	Pusa 44, HKR- 47, PR 113, PR-126, PR-128
Wheat	WH 711, DBW 17, PBW 502
Barseem	BL42, BL10
Multi-cut sorghum	SL44 , Punjab Sudax, Chari 1
Mustard	GSC6, GSC5
Sugarcane	TL 15 (toria), Hyola (sarson)
Maize	Hybrid Shell, Double (Monsanto), 31Y45

3.3. SEED RATE

Farmers in the region's six communities use varying seed rates for different crops (Table 3). Approximately 36 of farmers employ the recommended seed rate for rice cultivation, whereas a sizable 64 use a higher seed rate. Similarly, only 25.6 of farmers grow wheat at recommended rates, whereas a huge 74.4 grow it over recommended levels. In multi-cut sorghum, 31.2 of farmers follow suggested techniques, whereas 68.8 choose higher seed rates. Barseem, mustard, sugarcane, maize, and cauliflower follow suit, reflecting the area's diverse farming techniques and inclinations, as some farmers chose to use greater seed rates than recommended while others stick to official recommendations (Fig 2).

Table. 3. Seed rateof different crops

Crop name	Recommended Seed rate (in kg/hec.)	Above recommended seed rate (in kg/hec.)
Rice	36	64

Wheat	25.6	74.4
Multi-cut sorghum	31.2	68.8
Barseem	47.2	52.8
Mustard	44	56
Sugarcane	53.6	46.4
Maize	62.4	37.6
Cauliflower	65	35

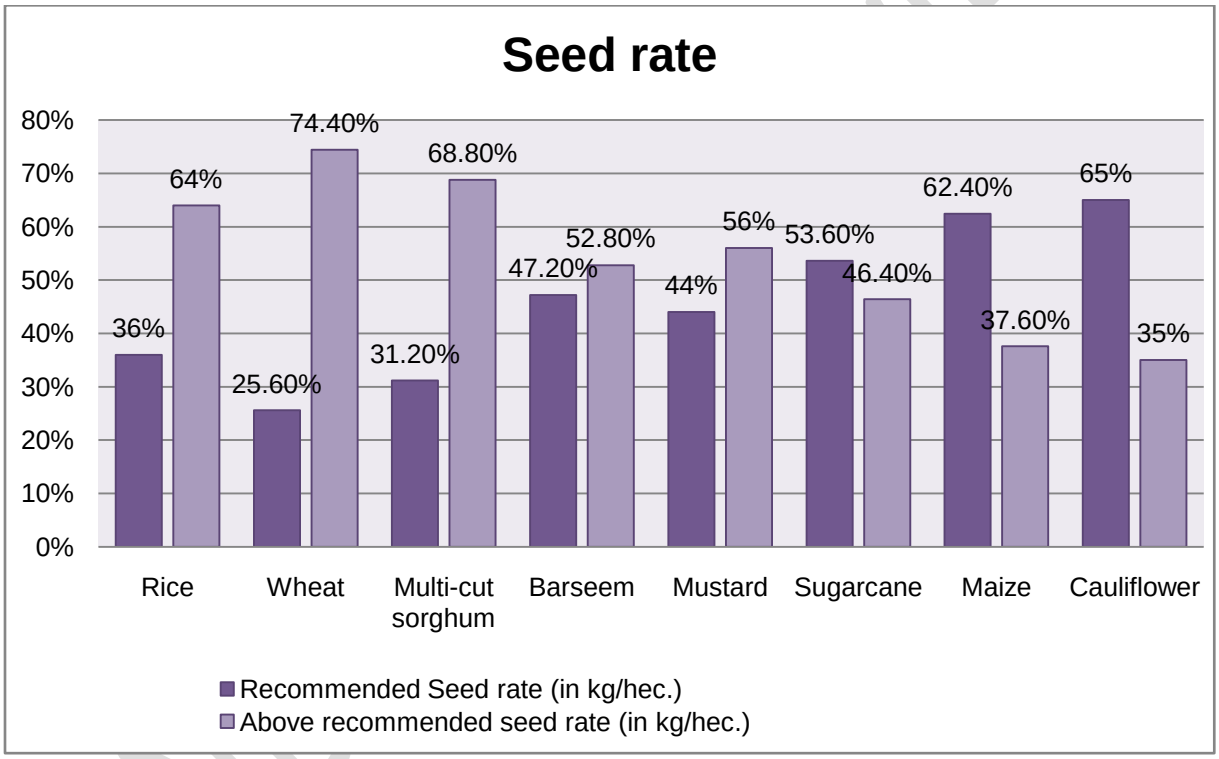


Fig.2. Seed rate

3.4. MACHINERY AND EQUIPMENT OWNED

The data (Table 4) demonstrates the wide range of agricultural approaches by providing insights into how farmers in various villages use machinery and equipment. In MandauliKhurad, Ratangarh, Ramgarh

Manda, Badwali, Bhateri, and Mandauli Kalan, various farming equipment is employed to differing degrees.

In Fig 3Tractors are a popular choice; MandauliKhurad comes in second with 60, followed by Ratangarh with 75. Plows, harrows, and levelers are used by 46.6 to 75 of the population. Cultivators and rotavators, on the other hand, have poor adoption rates ranging from 0 to 16. Seed drills are the least common in most communities, accounting for less than 5 of the equipment.

Table.4. machinery and equipment owned

Village name							
Machinary (% of total farmers)	**Mandaulikhurad**	**Ratangarh**	**Ramgarh Manda**	**Badwali**	**Bhateri**	**Mandaulikalan**	**Overall (% of total farmers)**
Tractor	60	75	72	53.3	80	76	**69.4**
Ploughs	60	70	64	53.3	68	72	**64.55**
Harrows	53.3	70	68	46.6	64	68	**61.65**
Cultivator	6.7	10	12	0	4	4	**6.1**
Rotavator	6.7	0	0	0	16	12	**5.8**
Leveller	53.3	75	64	53.3	76	76	**66.3**
Seed drills	0	0	0	0	4	0	**0.6**

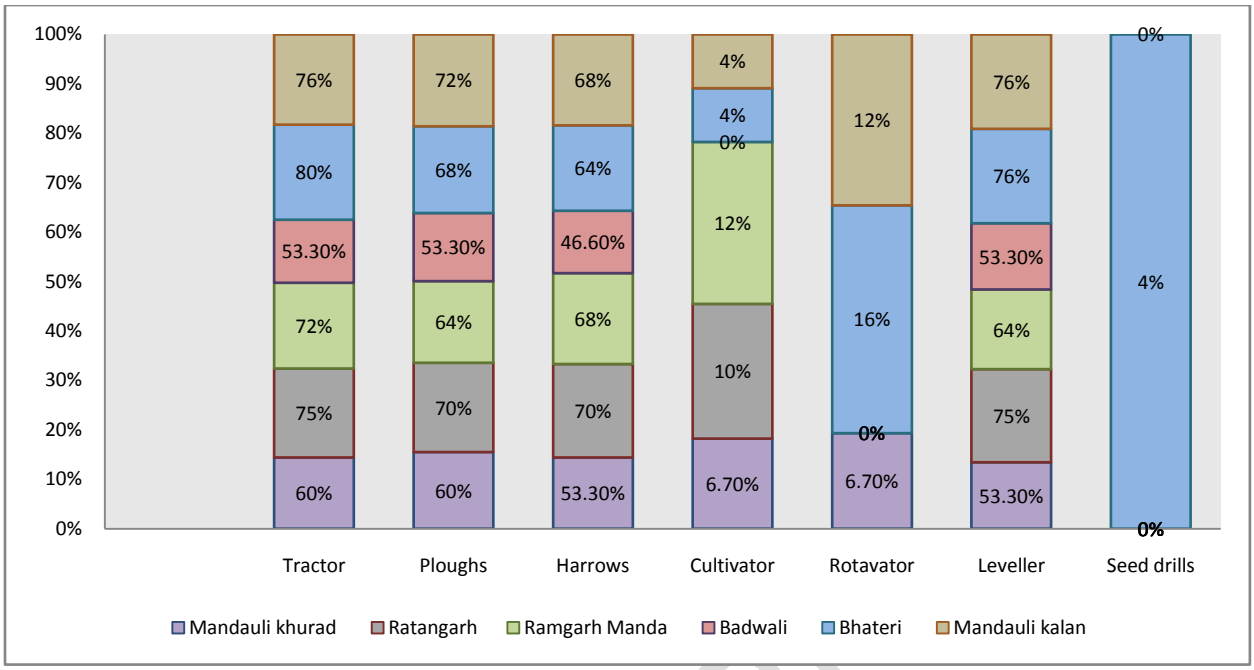


Fig 3. machinery and equipment owned

3.5. IRRIGATION SCHEDULE

The information (Table 5) sheds important light on the irrigation methods used by farmers in a number of different communities. Regarding the quantity of irrigations they use, farmers in MandauliKhurad, Ramgarh Manda, Badwali, Bhateri, and Mandauli Kalan use a variety of strategies.

A significant majority of farmers in MandauliKhurad and Bhateri—86 and 66, respectively—choose a more frequent strategy, choosing five to six irrigations. However, a sizable portion of farmers in Ratangarh and Ramgarh Manda—35.6 and 67, respectively—choose to use three to four irrigations

Table.5. No. of irrigations given to crops

No. of the irrigations (% of total farmers)	Mandaulikhurad	Ratangarh	Ramgarh Manda	Badwali	Bhateri	Mandaulikalan	overall
1-2	0	10	4	0	0	0	**2.3**

3-4	23	35.6	67	43	34	48	**41.8**
5-6	87	54.4	29	57	66	52	**57.6**

3.6. NUTRIENT MANAGEMENT

3.6.1. Organic manure usage

In table 6 ,Farm yard manure is most extensively employed in Bhateri (94) and Badwali (83), with an overall average of 76.7. Vermicompost sees noteworthy usage in Ratangarh (12), contributing to an overall high average of 59.7. Compost is predominantly used in Mandauli Kalan (21.6), while the overall average stands at 11.4. Other organic manure usage is limited, primarily found in Ratangarh (10), resulting in a minimal overall average of 2. These trends reflect the varying manure preferences, with Bhateri favoring farm yard manure, while vermicompost is widely adopted across the villages.

Table 6. Organic manure used by farmers in different villages

Manure (% of total farmers use)	**Mandaulikhurad**	**Ratangarh**	**Ramgarh Manda**	**Badwali**	**Bhateri**	**Mandaulikalan**	**Overall**
Farm yard manure	76	62	73	83	94	72	**76.7**
Vermicompost	7	12	21	9	4.3	6.4	**59.7**
Compost	17	16	4	8	1.7	21.6	**11.4**
Other organic manure	0	10	2	0	0	0	**2**

3.6.2. Inorganic fertilizer usage

Dose of urea applied

The data (Table 7 and Fig.4), presented in percentages, paints a clear picture of the various urea application procedures employed by farmers in various places. Although some farmers adhere to the recommended urea levels, others prefer to apply less or more than what is recommended. MandauliKhurad is remarkable for having 66.7 of farmers exceed the recommended urea levels, while only 20 adhere to the regulations. In Ratangarh, 85 of farmers exceed the prescribed quantity, while 15 strictly adhere to it. This data shows how agricultural practices are dynamic and influenced by a variety of factors such as crop kinds, soil conditions, and local customs. The varying percentages in each of these localities demonstrate the farmers' adaptability and flexibility in tailoring their urea application.

As recommended dosage of urea is around 224- 274 kg/hectare (90-110 kg/acre) for majority of crops. However, majority of farmers apply more than the necessary amount of urea which ultimately harm the plant and soil health [6,7,8]. Nitrogen application improves cell size, merismatic activity, and protoplasm production and function, all of which lead to increased crop development [9].

Table7. Urea dose

Amount of urea applied (kg/hec.) (% of total farmers apply)	**Mandauli khurad**	**Ratangarh**	**Ramgarh Manda**	**Badwali**	**Bhateri**	**Mandauli kalan**	**Overall**
Reccomended	20	15	28	33.3	32	4	**22.7**
Below recommended	13.3	0	0	0	4	4	**4**
Above recommended	66.7	85	72	66.7	64	92	**74.4**

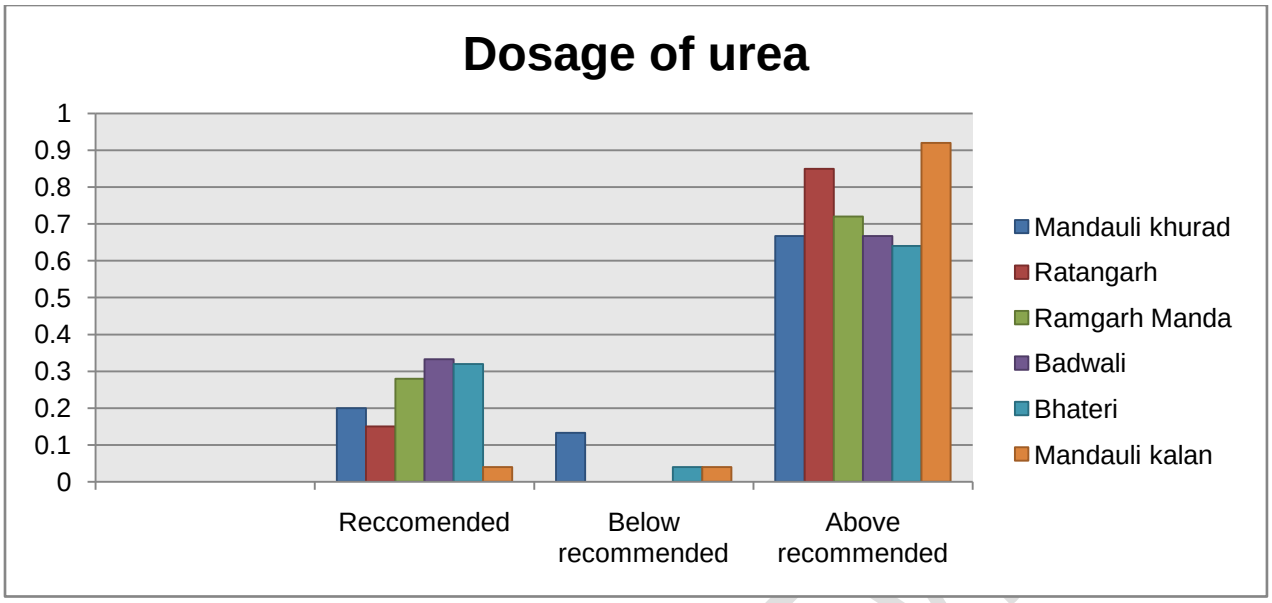


Fig 4. Dosage of urea

Dose of DAP

The data (Table 8 and fig. 5) illustrates the varied DAP (Diammonium Phosphate) application practices among farmers in different villages, presented in precise percentages. In MandauliKhurad, 46.7 of farmers align with the recommended DAP application, while 13.3 apply below the recommended rate, and 40 opt for higher levels. Ratangarh shows 45 adhering to the recommendations, 15 using less DAP, and 40 surpassing the suggested application. In contrast, Ramgarh Manda demonstrates 32 following recommendations, 12 below, and 56 exceeding them. This data reflects the dynamic agricultural landscape shaped by local factors, crop types, and traditions, highlighting the adaptability of farmers as they make tailored choices to suit their specific needs and local conditions.

Table.8. Dosage of DAP applied by farmers

Amount of DAP applied (kg/hec.)(% of total farmers use)	Mandaulikhurad	Ratangarh	Ramgarh Manda	Badwali	Bhateri	Mandaulikalan	**Overall**
Reccomende	46.7	45	32	53.3	44	48	**45**

d							
Below recommended	13.3	15	12	0	8	12	**10**
Above recommended	40	40	56	46	48	40	**45.1**

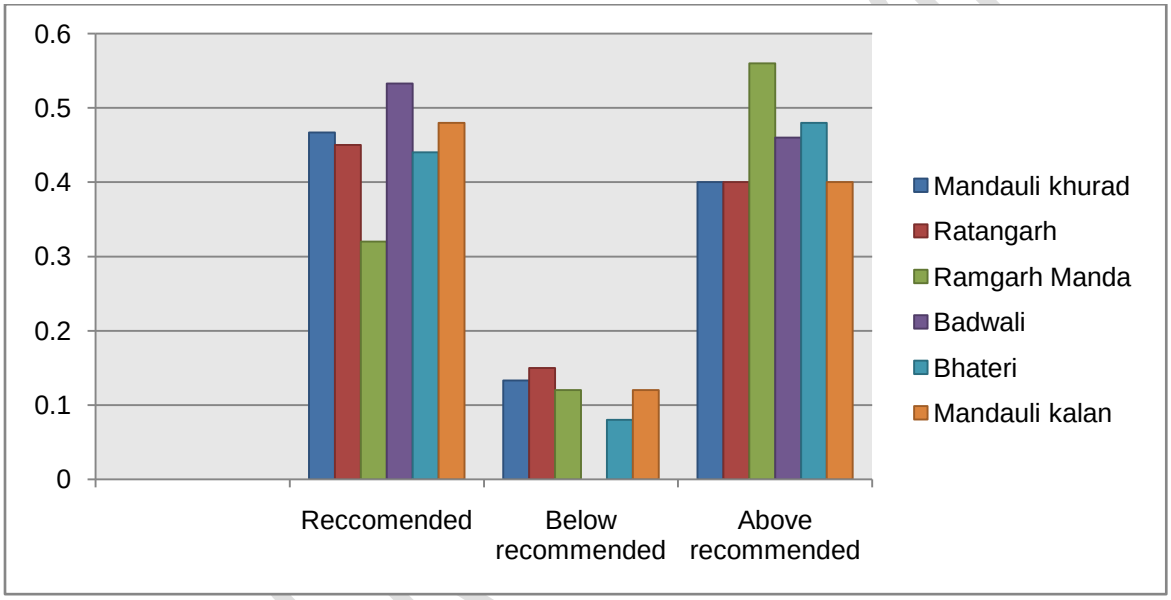


Fig 5. dosage of DAP

3.6. WEED MANAGEMENT

In six distinct villages, seasonal differences in the frequency of important weed species have been identified (Table 9) These settlements have a large diversity of common grasses. Crow foot grass (Dactylocteniumaegyptium), Goose grass (Eleusine indica), Love grass (Eragrostistenella), Sandbur (Cenchrus catharticus), and Crab grass (Digitariasanguinalis) take center stage during the Kharif season. Canary grass (Phalaris minor), wild oats (Avena ludoviciana), and beard grass (Polypogenmonspellensis) are prevalent throughout the Rabi season.

Table 9. Major weeds identified in Rupnagar

Common name	Scientific name	Season	Percentage (% of total farmers encounter)
Canary grass	*Phalaris minor*	**Rabi**	**100**
Crow foot grass	*Dactylocteniumaegyptium*	**Kharif**	**100**
Goose grass	*Eleusine indica*	**Kharif**	**96**
Love grass	*Eragrostistenella*	**Kharif**	**60**
Sandbur	*Cenchrus catharticus*	**Kharif**	**46**
Crab grass	*Digitariasanguinalis*	**Kharif**	**35**
Wild Oats	*Avena ludoviciana*	**Rabi**	**20**
Beard grass	*Polypogenspp.*	**Rabi**	**10.2**

Controlling weed species is critical to maintaining agricultural productivity in these six settlements. Different herbicides are employed as vital tools to control the great diversity of common grasses (Table 10). Herbicide selection is tailored to the specific weed species and seasonal requirements. In these areas, herbicides such as Nominee Gold (80.45), Avkira (59.28), Axial (24.83), Pretilachlor (18.2), and Leader (10.3) are commonly used. These herbicides are critical for weed control as well as crop health and productivity. They are employed in a method that allows for responsible and efficient weed management in these agriculturally diverse regions, taking aspects like weed kind, development stage, and environmental considerations into account.

Table 10. Different herbicides use to control weeds.

S. No.	Herbicide	Percentage (% of total farmers use)
1.	Nominee gold	80.45
2.	Avkira	59.28
3.	Axial	24.83

4.	Pretilachlor	18.2
5.	Leader	10.3

3.7. PEST MANAGEMENT

The incidence of numerous pests varies across the researched areas, affecting agricultural operations (Table 11). MandauliKhurad has the highest percentage of leaf hoppers and aphids, at 93.3 and 86.7, respectively, but Ratangarh is not far behind, with 90 and 85, respectively. The presence of aphids in Ramgarh Manda is 96. Significant aphid infestations have been observed in Badwali (93.3) and Bhateri (92). Mandauli Kalan has a high proportion of leaf hoppers—96. Stem borers are rare; MandauliKhurad has the highest incidence rate, at 46.5. These figures illustrate the importance of effective pest management plans that are tailored to the specific challenges that each region faces.

Table 11. Common pests found in villages of Rupnagar

Pest (% of total farmers encounter)	**Mandaulikhurad**	**Ratangarh**	**Ramgarh Manda**	**Badwali**	**Bhateri**	**Mandaulikalan**	**Overall**
Leaf hopper	93.3	90	95	86.7	92	96	92.2
Aphids	86.7	85	96	93.3	92	88	90.2
Stem boror	46.5	45	44	40	44	40	43.25
Other pests	6.7	5	4	0	0	4	3.28

Pesticide spraying is critical in these agricultural settings for crop protection and pest control. In Table 12., MandauliKhurad and Badwali lead the way in pest management with a 100 chloropyriphos usage rate. Ratangarh and Ramgarh Manda both choose Coragen, with 95 and 92 of the vote, respectively. Notably, imidacloprid is used in 46.7 percent of Badwali and 50 of Ratangarh. The entire statistics reflect a regional average, with chloropyriphos at 95.50, coragen at 90.95, and imidacloprid at 42.78. These pesticide use patterns reflect the distinct agricultural requirements and obstacles found in these varied regions.

Table 12. Major pesticides used by farmers

Pesticide	Mandaulikhurad	Ratangarh	Ramgarh Manda	Badwali	Bhateri	Mandaulikalan	Overall
Chloropyriphos	100	90	95	100	96	92	95.50
Coragen	100	95	92	86.7	84	88	90.95
Imidacloprid	40	50	44	46.70	36	40	42.78

3.8. DISEASE MANAGEMENT

The incidence of numerous ailments in the agricultural landscape of Rupnagar's six distinct villages has an impact on crop health and productivity. In Table 13, it is shown that Brown rust, a serious danger, is found in Mandaulikhurad (100) and Ramgarh Manda (88), with the highest concentrations in Ratangarh (80) and Badwali (80). Yellow rust is constantly 80 widespread in every village. Meanwhile, powdery mildew is most prevalent in Ratangarh (65) and Mandaulikhurad (60). The entire data underscores the importance of disease management in these various agricultural areas by emphasizing the average 86 regional problem of brown rust, as well as the prevalence of yellow rust and powdery mildew.

Table 13. Major diseases found in Rupnagar district

Disease (% of total farmers encounter)	Mandaulikhurad	Ratangarh	Ramgarh Manda	Badwali	Bhateri	Mandaulikalan	Overall
Brown rust	100	80	88	80	84	84	**86.**
Yellow rust	80	80	80	80	80	80	**80**
Powdery mildew	60	65	64	60	36	40	**54.17**

Disease control is critical for crop health and yield in Rupnagar's six villages. (Table 14.)Nativo is the chemical of choice for disease management in these places; it is utilized 100 of the time in Mandaulikhurad, Ratangarh, Ramgarh Manda, Badwali, and Bhateri. Mandauli Kalan, on the other hand, has a somewhat lower usage rate of 84. Another frequent chemical is mancozeb, which is used at rates

ranging from 60 to 65 in a number of villages, while propiconazol is used at rates ranging from 4 to 20. Overall, the statistics show a 97.3 average heavy reliance on Nativo, with Mancozeb and Propiconazol also playing key roles in sickness management in these diverse agricultural areas.

Table 14. Common chemical control in Rupnagar district of Punjab

Chemical used for disesase management (% of total farmers use)	Mandaulikhurad	Ratangarh	Ramgarh Manda	Badwali	Bhateri	Mandaulikalan	Overall
Nativo	100	100	100	100	100	84	97.3
Mancozeb	60	65	64	60	36	40	51.2
Propiconazol	13.3	15	20	6.7	4	4	10.5

3.9. YIELD

3.9.1. Yield of Wheat

The data (Table 15) reveals the distribution of wheat yield per hectare across six villages, including MandauliKhurad, Ratangarh, Ramgarh Manda, Badwali, Bhateri, and Mandauli Kalan. It shows that the majority of wheat yields in the "37-50q" and "51-62q" categories are concentrated in most of the villages, with Mandauli Kalan standing out for its high yield in the "51-62q" category. However, in the "More than 62q" category, the yield is relatively low across all villages, with Bhateri having the highest percentage. The overall average wheat yield in all six villages falls into the "51-62q" category.

Table 15. Yield of wheat in different villages of rupnagar

S. No.	Wheat yield (Quintals/hec.) (% of total farmers get)	Mandaulikhurad	Ratangarh	Ramgarh Manda	Badwali	Bhateri	Mandaulikalan	Overall
1.	37-50	40	50	44	46.7	36	40	**43**
2.	51-62	53.3	55	48	53.3	52	60	**54**
3.	More than 62	6.7	5	8	0	12	0	**3.6**

3.9.2. Yield of Rice

(Table 16)In the "37-50" quintals/hec. category, MandauliKhurad, Ramgarh Manda, and Mandauli Kalan have the highest percentages of yield, while in the "51-62" category, Ratangarh, Bhateri, and Ramgarh Manda lead. The overall average rice yield leans towards the "37-50" category, with a slight majority at 51 for that range.

Table 16. Yield of rice in different villages

S. No.	Rice yield (quintals/hec.) (% of total farmers get)	Mandaulikhurad	Ratangarh	Ramgarh Manda	Badwali	Bhateri	Mandaulikalan	Overall
1.	37-50	53.3	50	52	46.7	48	56	**51**
2.	51-62	46.7	50	48	53.3	52	44	**49**

4. CONCLUSION

Conclusively, the examined villages' agricultural environment paints a multifaceted image of crop diversity, differing degrees of automation, and a variety of nutrient management techniques. Rice and wheat are the main crops grown in these areas, however multi-cut sorghum and a few other crops are also grown to a lesser degree. The variety of crops in the area reflects farmers' preferences and wants, underscoring the significance of comprehending local market dynamics and agricultural needs.Each village has a different level of mechanization, but the most prevalent type of agricultural equipment owned

is a tractor. The degree of mechanization and equipment ownership, however, varies from village to village, reflecting the different farming methods and resources that the farmers have at their disposal. Crop varieties show diversity, with different choices for rice, wheat, and mustard. This diversity can be beneficial in terms of crop resilience and adaptation to changing environmental conditions. The analysis of seed rate management reveals that some farmers tend to use significantly more seeds than recommended, while others fall short. This emphasizes the need for promoting optimal seed rate practices, which can have a direct impact on crop yields and resource utilization. The data also provides insights into nutrient management practices, both organic and inorganic. While farm yard manure and vermicompost are the preferred organic options, there is considerable variation in the application of urea and DAP fertilizers. Notably, many farmers tend to apply more urea than recommended, signaling a potential area for optimizing nutrient management and reducing environmental impact. The yield data for wheat and rice showcases that the majority of yields fall into the "37-50 quintals/hec." category. Mandauli Kalan stands out for its higher yields in the "51-62 quintals/hec." range. However, challenges exist in achieving higher yields in the "More than 62 quintals/hec." category, with varying success among the villages. This underscores the importance of agricultural extension services and support for farmers to enhance productivity and sustainable agricultural practices. To ensure long-term sustainability, it is crucial to promote practices that optimize resource use, preserve the environment, and enhance agricultural productivity while taking into account the local context and specific needs of each village. Agricultural education and support are key to achieving these goals, as are policies that encourage environmentally sustainable practices and diversification of crops beyond rice and wheat.

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