

# 1 **Assessing Agricultural Practices and Plant protection** 2 **methods in Rupnagar District, Punjab, India**

## 3 4 **ABSTRACT**

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

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

10 **Methodology:**The study employed a mixed-methods approach, combining field surveys and structured  
11 interviews with 120 farmers across six villages in Rupnagar District, Punjab, India. Data on crop types,  
12 seed rates, machinery usage, and nutrient management were collected. Random sampling ensured  
13 representativeness, providing comprehensive insights into agricultural practices and challenges in the  
14 region.

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

18 **Results:** According to the data, the two main crops grown in the research areas were rice and wheat.  
19 Among the various degrees of mechanization observed, tractors were the most frequently visible piece of  
20 equipment. Seed rate management varied, and some farmers used more seed than was recommended.  
21 The data revealed a diversity of nutrient management approaches, as well as a proclivity for urea  
22 overuse. These findings offer insight on how complex the farming methods in the area are.

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

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

27

## 28 **1. INTRODUCTION**

29 Agriculture, often referred to as the backbone of many economies, plays a pivotal role in ensuring food  
30 security, economic prosperity, and the overall well-being of nations [3]. Growing population and high  
31 consumption rates place previously unheard-of strains on agricultural and natural resources [14]. This  
32 agricultural prowess extends well beyond state borders, as India is one of the world's major agricultural  
33 hubs, supplying a diverse range of crops to the global market [1]. Furthermore, given that India will have  
34 more people by 2027 (based on United Nations population forecasts from 2019), it will be incredibly  
35 difficult for Indian agriculture to feed this massive population. This is especially true in light of climate  
36 change and the depletion of natural resources such as air, water, and land [15]. Agriculture's profound  
37 implications are further underscored when considering its vital role in addressing the increasing  
38 challenges of a growing global population [3]. This significance is particularly exemplified in Punjab, a  
39 northern state of India. Known as the "Granary of India," agriculture sector of Punjab has been  
40 instrumental in providing sustenance to its population and contributing substantially to the nation's grain  
41 reserves [2,5]. As of the introduction of modern agricultural technologies such as chemical fertilizers,  
42 irrigation systems, and high-yielding wheat seed varieties, the Punjab economy expanded rapidly after  
43 green revolution [13]. Also, There have been various plant protection methods used in Punjab. Farmers  
44 who have a low tolerance for pest infestations use a lot of fertilizer. Furthermore, the public sector  
45 encourages the use of IPM, environmentally friendly pest management approaches, and insecticides [16].  
46 Integrated farming system reduces the cost of production by recycling the residues in the field and also  
47 helps to conserve water, soil health and nutrients which decrease their dependence on excessive  
48 chemicals [17]. Several reports have highlighted the effect of indiscriminate and excessive use of  
49 pesticides not only on human health but also the environment [18]. Agriculture can regularly feed food and

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

55 In the ever-evolving landscape of agricultural education, a transformative program known as the Rural  
56 Agricultural Work Experience (RAWE) program has taken root in agricultural universities across India [4].  
57 This research aims to characterize the agricultural practices followed by farmers and analyze the data to  
58 identify any emerging trends, patterns, or commonalities among different agricultural practices.

59

## 60 2. MATERIAL AND METHODS

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



64

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

70 Among the principal data collection sources were:

- 71 1. Direct Interviews: Researchers asked questions of the farmers face-to-face and noted their answers.
- 72 2. On-site observations were conducted by the researchers regarding farming techniques, including the
- 73 availability of agricultural machinery and the state of the crops.
- 74 3. Historical Records: A question concerning years of experience and past modifications to farming
- 75 methods was posed to farmers.

76

77 Random sampling is used in surveys. In random sampling, a portion of the population (farmers in this

78 case) is chosen at random, offering each person an equal chance of being included in the sample. To

79 assure representativeness, this technique is frequently applied [12].

80 A total of 120 farmers were surveyed and data were collected. From Mandaulikhrad, 15 respondents

81 were interviewed, from Ratangarh, 20 respondents were interviewed and from Ramgarh manda, Badwali,

82 Bhatari and Mandaulikalan, 25, 15, 25, 25 respondents were interviewed respectively. During the survey

83 conducted, the major crops were Rice, Wheat, Barseem (fodder) and Multi-cut sorghum (fodder) whereas

84 other crops which are grown by less farmers were vegetables and sugarcane.

85

### 86 **3. RESULTS AND DISCUSSION**

87 Farmers have begun to use increasing dosages of chemical fertilizers and other agro-chemicals in order

88 to sustain current levels of food grain output, which has impacted the ecology. As a result, farmers must

89 be educated about the importance of sustainable agriculture, the financial benefits of conservation

90 technology and practices to both the state and farmers, and the need for them to demonstrate these

91 techniques on their farms in order to preserve Punjabi agriculture. To compete in the market with rice

92 wheat systems, government policies must be amended to encourage natural resource management and

93 environmental conservation. Maize, pulses, oilseeds, milk, and other products also require assistance, as

94 does the building of supply and value chain systems for these items. [5].

95 There are various research options available to increase crop yields. There are numerous options

96 for rice, Punjab's main crop: improved rice cultivars, optimal pesticide use, the use of laser leveling and

97 furrow irrigated raised beds (FIRB) technologies, the matching of water availability with land use systems,

98 the adoption of practices free of distortion, integrated crop management, strengthened crop improvement

99 programs, integrated pest and disease management, integrated nutrient management, site-specific  
 100 nutrient management (SSNM). [10].

101 **3.1. MAJOR CROPS GROWN**

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

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114 **Table. 1. Crops grown by farmers in different villages of Rupnagar district**

Crops grown (% of total farmers )									
Village name	Rice	Wheat	Multi-cut sorghum	Barseem	mustard	Sugarcane	Maize	Cauliflower	Other crops
<b>Mandauli Khurad</b>	100	100	93.3	86.7	40	6.7	6.7	13.3	0
<b>Ratangarh</b>	100	100	90	85	75	15	20	0	10
<b>Ramgarh Manda</b>	92	100	96	96	60	0	0	4	0
<b>Badwali</b>	100	100	93.3	86.7	60	20	26.7	6.7	13.4

<b>Bhateri</b>	92	100	96	92	44	4	12	12	0
<b>Mandaulikalan</b>	100	100	92	76	56	0	8	0	0
<b>Total</b>	<b>97.3</b>	<b>100</b>	<b>93.4</b>	<b>87.06</b>	<b>55.8</b>	<b>7.61</b>	<b>12.2</b>	<b>6</b>	<b>3.9</b>

115

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

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### 121 3.2. COMMONLY GROWN VARIETIES

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

130

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

<b>Crop name</b>	<b>Varieties grown</b>
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

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133 **3.3. SEED RATE**

134 Farmers in the region's six communities use varying seed rates for different crops (Table 3).  
135 Approximately 36% of farmers employ the recommended seed rate for rice cultivation, whereas a sizable  
136 64% use a higher seed rate. Similarly, only 25.6% of farmers grow wheat at recommended rates,  
137 whereas a huge 74.4% grow it over recommended levels. In multi-cut sorghum, 31.2% of farmers follow  
138 suggested techniques, whereas 68.8% choose higher seed rates. Barseem, mustard, sugarcane, maize,  
139 and cauliflower follow suit, reflecting the area's diverse farming techniques and inclinations, as some  
140 farmers chose to use greater seed rates than recommended while others stick to official  
141 recommendations.

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**Table. 3. Seed rate of different crops**

<b>Crop name</b>	<b>Recommended Seed rate [%of farmers follow]</b>	<b>Above recommended seed rate [%of farmers follow]</b>
Rice	36	64
Wheat	25.6	74.4
Multi-cut sorghum	31.2	68.8
Barseem	47.2	52.8
Mustard	44	56

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Sugarcane	53.6	46.4
Maize	62.4	37.6
Cauliflower	65	35

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152 **3.4. MACHINERY AND EQUIPMENT OWNED**

153 The data (Table 4) demonstrates the wide range of agricultural approaches by providing insights into how  
 154 farmers in various villages use machinery and equipment. In Mandauli Khurad, Ratangarh, Ramgarh  
 155 Manda, Badwali, Bhateri, and Mandauli Kalan, various farming equipment is employed to differing  
 156 degrees.

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

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**Table.4. machinery and equipment owned**

Village name							
Machinar y (% of total farmers)	Mandaulikhura d	Ratangar h	Ramgar h Manda	Badwal i	Bhater i	Mandaulikala n	Overall (% of total farmers )
<b>Tractor</b>	60	75	72	53.3	80	76	<b>69.4</b>

<b>Ploughs</b>	60	70	64	53.3	68	72	<b>64.55</b>
<b>Harrows</b>	53.3	70	68	46.6	64	68	<b>61.65</b>
<b>Cultivator</b>	6.7	10	12	0	4	4	<b>6.1</b>
<b>Rotavator</b>	6.7	0	0	0	16	12	<b>5.8</b>
<b>Leveller</b>	53.3	75	64	53.3	76	76	<b>66.3</b>
<b>Seed drills</b>	0	0	0	0	4	0	<b>0.6</b>

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168 **3.5. IRRIGATION SCHEDULE**

169 The information (Table 5) sheds important light on the irrigation methods used by farmers in a number of  
170 different communities. Regarding the quantity of irrigations they use, farmers in Mandauli Khurad,  
171 Ramgarh Manda, Badwali, Bhatari, and Mandauli Kalan use a variety of strategies. A significant majority  
172 of farmers in MandauliKhurad and Bhatari—86% and 66%, respectively—choose a more frequent  
173 strategy, choosing five to six irrigations. However, a sizable portion of farmers in Ratangarh and Ramgarh  
174 Manda—35.6% and 67%, respectively—choose to use three to four irrigations

175 **Table.5. No. of irrigations given to crops**

<b>No. of the irrigations (% of total farmers)</b>	<b>Mandaulikhurad</b>	<b>Ratangarh</b>	<b>Ramgarh</b>	<b>Badwali</b>	<b>Bhatari</b>	<b>Mandaulikalan</b>	<b>overall</b>
	<b>Manda</b>						
<b>1-2</b>	0	10	4	0	0	0	<b>2.3</b>
<b>3-4</b>	23	35.6	67	43	34	48	<b>41.8</b>
<b>5-6</b>	87	54.4	29	57	66	52	<b>57.6</b>

176 **3.6. NUTRIENT MANAGEMENT**

177 **3.6.1. Organic manure usage**

178 In table 6 ,Farm yard manure is most extensively employed in Bhatari (94%) and Badwali (83%), with an  
179 overall average of 76.7%. Vermicompost sees noteworthy usage in Ratangarh (12%), contributing to an  
180 overall high average of 59.7%. Compost is predominantly used in Mandauli Kalan (21.6%), while the

181 overall average stands at 11.4%. Other organic manure usage is limited, primarily found in Ratangarh  
 182 (10%), resulting in a minimal overall average of 2%. These trends reflect the varying manure preferences,  
 183 with Bhateri favoring farm yard manure, while vermicompost is widely adopted across the villages.

184 **Table 6. Organic manure used by farmers in different villages**

<b>Manure (% of total farmers use)</b>	<b>Mandaulikhura</b>	<b>Ratangarh</b>	<b>Ramgarh</b>	<b>Badwal</b>	<b>Bhateri</b>	<b>Mandaulikala</b>	<b>Overall</b>
<b>Farmyard manure</b>	76	62	73	83	94	72	<b>76.7</b>
<b>Vermicompost</b>	7	12	21	9	4.3	6.4	<b>59.7</b>
<b>Compost</b>	17	16	4	8	1.7	21.6	<b>11.4</b>
<b>Other organic manure</b>	0	10	2	0	0	0	<b>2</b>

185

### 186 **3.6.2. Inorganic fertilizer usage**

#### 187 **Dose of urea applied**

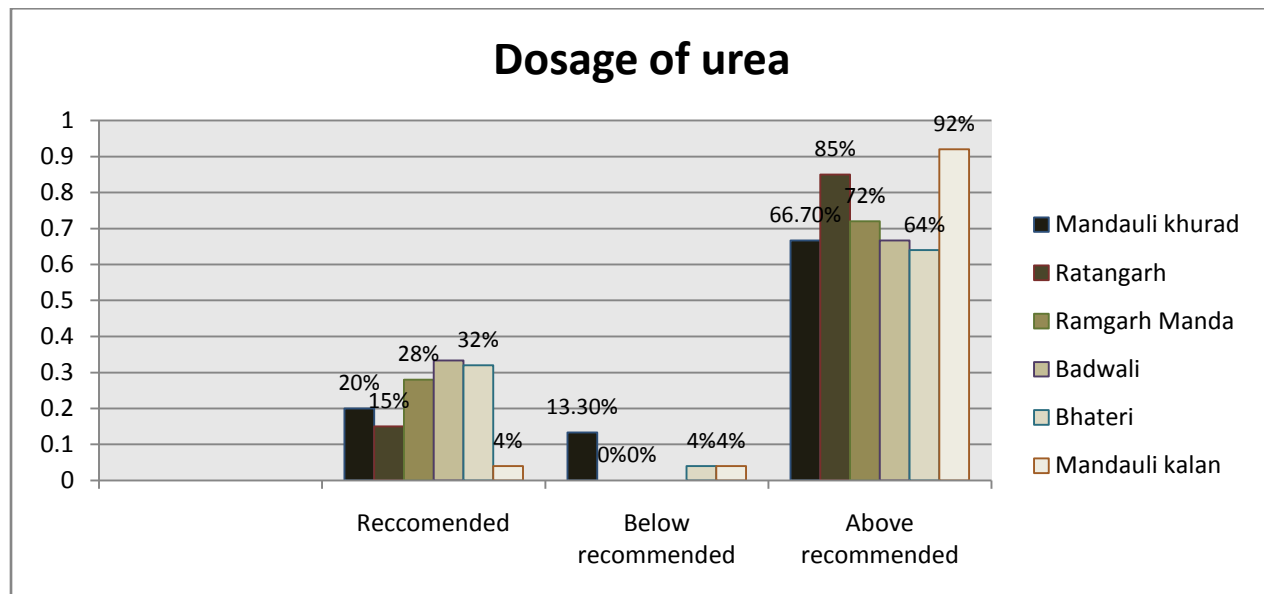
188 The data (Fig. 5), presented in percentages, paints a clear picture of the various urea application  
 189 procedures employed by farmers in various places. Although some farmers adhere to the recommended  
 190 urea levels, others prefer to apply less or more than what is recommended. Mandauli Khurad is  
 191 remarkable for having 66.7% of farmers exceed the recommended urea levels, while only 20% adhere to  
 192 the regulations. In Ratangarh, 85% of farmers exceed the prescribed quantity, while 15% strictly adhere  
 193 to it. This data shows how agricultural practices are dynamic and influenced by a variety of factors such  
 194 as crop kinds, soil conditions, and local customs. The varying percentages in each of these localities  
 195 demonstrate the farmers' adaptability and flexibility in tailoring their urea application.

196 As recommended dosage of urea is around 224- 274 kg/hectare (90-110 kg/acre) for majority of crops.

197 However, majority of farmers apply more than the necessary amount of urea which ultimately harm the

198 plant and soil health [6,7,8]. Nitrogen application improves cell size, meristematic activity, and  
 199 protoplasm production and function, all of which lead to increased crop development [9].

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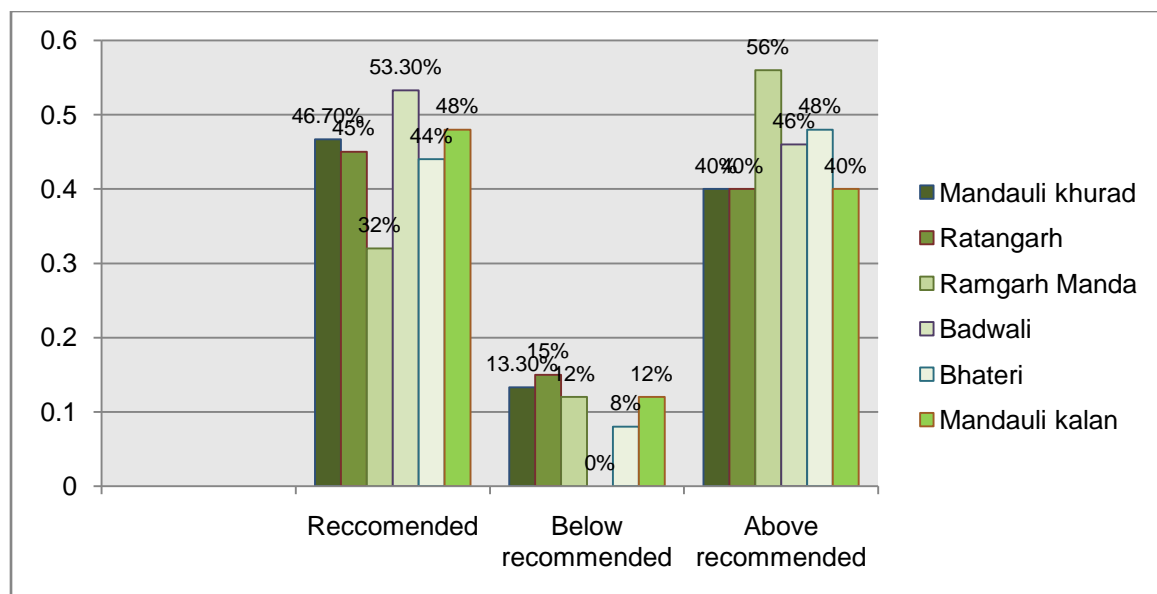
202 **Fig 5. Dosage of urea**

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204 **Dose of DAP**

205 The data (Fig. 6) illustrates the varied DAP (Diammonium Phosphate) application practices among  
 206 farmers in different villages, presented in precise percentages. In Mandauli Khurad, 46.7% of farmers  
 207 align with the recommended DAP application, while 13.3% apply below the recommended rate, and 40%  
 208 opt for higher levels. Ratangarh shows 45% adhering to the recommendations, 15% using less DAP, and  
 209 40% surpassing the suggested application. In contrast, Ramgarh Manda demonstrates 32% following  
 210 recommendations, 12% below, and 56% exceeding them. This data reflects the dynamic agricultural  
 211 landscape shaped by local factors, crop types, and traditions, highlighting the adaptability of farmers as  
 212 they make tailored choices to suit their specific needs and local conditions.

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214

215

**Fig 6. Dosage of DAP**

216 **3.6. WEED MANAGEMENT**

217 In six distinct villages, seasonal differences in the frequency of important weed species have been  
 218 identified (Table 7) These settlements have a large diversity of common grasses. Crow foot grass  
 219 (*Dactyloctenium aegyptium*), Goose grass (*Eleusine indica*), Love grass (*Eragrostis tenella*), Sandbur  
 220 (*Cenchrus catharticus*), and Crab grass (*Digitaria sanguinalis*) take center stage during the Kharif season.  
 221 Canary grass (*Phalaris minor*), wild oats (*Avena ludoviciana*), and beard grass (*Polypogon*  
 222 *monspellensis*) are prevalent throughout the Rabi season.

223

**Table 7. Major weeds identified in Rupnagar**

Common name	Scientific name	Season	Percentage (% of total farmers encounter)
Canary grass	<i>Phalaris minor</i>	Rabi	100
Crow foot grass	<i>Dactyloctenium aegyptium</i>	Kharif	100
Goose grass	<i>Eleusine indica</i>	Kharif	96
Love grass	<i>Eragrostis tenella</i>	Kharif	60

Sandbur	<i>Cenchrus</i>	Kharif	<b>46</b>
	<i>catharticus</i>		
Crab grass	<i>Digitaria</i>	Kharif	<b>35</b>
	<i>sanguinalis</i>		
Wild Oats	<i>Avena</i>	Rabi	<b>20</b>
	<i>ludoviciana</i>		
Beard grass	<i>Polypogen spp.</i>	Rabi	<b>10.2</b>

224

225 Controlling weed species is critical to maintaining agricultural productivity in these six settlements.

226 Different herbicides are employed as vital tools to control the great diversity of common grasses (Table

227 10). Herbicide selection is tailored to the specific weed species and seasonal requirements. In these

228 areas, herbicides such as Bispyribac Sodium 10% SC (80.45%), Pyroxasulfone 85% G (59.28%), Axial-

229 45 g/l (4.5 % w/w) pinoxaden, 5 g/l florasulam (0.5 % w/w) and 11.25 g/l (1.1 % w/w) cloquintocet-mexyl

230 (24.83%), Pretilachlor- 2-chloro-2', 6'-diethyl-N-(2-propoxyethyl) acetanilide (18.2%), and Sulfosulfuron

231 75% WG (10.3%) are commonly used. These herbicides are critical for weed control as well as crop

232 health and productivity. They are employed in a method that allows for responsible and efficient weed

233 management in these agriculturally diverse regions, taking aspects like weed kind, development stage,

234 and environmental considerations into account.

235

236

**Table 8. Different herbicides use to control weeds.**

<b>S. No.</b>	<b>Herbicide</b>	<b>Chemical name</b>	<b>Percentage (% of total farmers use)</b>
1.	Nominee gold	Bispyribac Sodium 10% SC	80.45
2.	Avkira	Pyroxasulfone 85% G	59.28
3.	Axial	45 g/l (4.5 % w/w) pinoxaden, 5 g/l florasulam (0.5 % w/w) and 11.25 g/l (1.1 % w/w) cloquintocet-mexyl	24.83
4.	Pretilachlor	2-chloro-2',	18.2

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6'-diethyl-N-(2-propoxyethyl)

acetanilide

5. Leader Sulfosulfuron 75% WG 10.3

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238 **3.7. PEST MANAGEMENT**

239 The incidence of numerous pests varies across the researched areas, affecting agricultural operations  
240 (Table 9). Mandauli Khurad has the highest percentage of leaf hoppers and aphids, at 93.3% and 86.7%,  
241 respectively, but Ratangarh is not far behind, with 90% and 85%, respectively. The presence of aphids in  
242 Ramgarh Manda is 96%. Significant aphid infestations have been observed in Badwali (93.3%) and  
243 Bhateri (92%). Mandauli Kalan has a high proportion of leaf hoppers—96%. Stem borers are rare;  
244 Mandauli Khurad has the highest incidence rate, at 46.5%. These figures illustrate the importance of  
245 effective pest management plans that are tailored to the specific challenges that each region faces.

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247

**Table 9. Common pests found in villages of Rupnagar**

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

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249 Pesticide spraying is critical in these agricultural settings for crop protection and pest control. In Table 10.,  
 250 MandauliKhurad and Badwali lead the way in pest management with a 100%chlorpyriphos usage rate.  
 251 Ratangarh and Ramgarh Manda both choose Chlorantraniliprole 18.5 % w/w , with 95% and 92% of the  
 252 vote, respectively. Notably, imidacloprid is used in 46.7 percent of Badwali and 50% of Ratangarh. The  
 253 entire statistics reflect a regional average, with chlorpyriphos at 95.50%, Chlorantraniliprole 18.5 % w/w  
 254 at 90.95%, and imidacloprid at 42.78%. These pesticide use patterns reflect the distinct agricultural  
 255 requirements and obstacles found in these varied regions.

256 **Table 10. Major pesticides used by farmers**

<b>Pesticide</b>	<b>(%of</b>	<b>Mandaulikhur</b>	<b>Ratangar</b>	<b>Ramgar</b>	<b>Badwa</b>	<b>Bhate</b>	<b>Mandaulikal</b>	<b>Overall</b>
<b>farmers use)</b>	<b>ad</b>	<b>h</b>	<b>h</b>	<b>li</b>	<b>ri</b>	<b>an</b>	<b>l</b>	<b>(%of</b>
				<b>Manda</b>				<b>farmer</b>
								<b>s use)</b>
<b>Chlorpyriphos</b>	100	90	95	100	96	92	95.50	
<b>Chlorantranilipr ole 18.5 % w/w</b>	100	95	92	86.7	84	88	90.95	
<b>Imidacloprid</b>	40	50	44	46.70	36	40	42.78	

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258 **3.8. DISEASE MANAGEMENT**

259 The incidence of numerous ailments in the agricultural landscape of Rupnagar's six distinct villages has  
 260 an impact on crop health and productivity. In Table 11, it is shown that Brown rust, a serious danger, is  
 261 found in Mandaulikhurad (100%) and Ramgarh Manda (88%), with the highest concentrations in  
 262 Ratangarh (80%) and Badwali (80%). Yellow rust is constantly widespread in every village. Meanwhile,  
 263 powdery mildew is most prevalent in Ratangarh (65%) and Mandaulikhurad (60%). The entire data  
 264 underscores the importance of disease management in these various agricultural areas by emphasizing  
 265 the average 86 regional problem of brown rust, as well as the prevalence of yellow rust and powdery  
 266 mildew.

267

268 **Table 11. Major diseases found in Rupnagar district**

Disease (% of total farmers encounter )	Mandaulikhura d	Ratangar h	Ramgar h Manda	Badwal i	Bhater i	Mandaulikala n	Overall l
<b>Brown rust</b>	100	80	88	80	84	84	<b>86.</b>
<b>Yellow rust</b>	80	80	80	80	80	80	<b>80</b>
<b>Powdery mildew</b>	60	65	64	60	36	40	<b>54.17</b>

269

270 Disease control is critical for crop health and yield in Rupnagar's six villages. (Table 12.)Tebuconazole  
271 50%+ Trifloxystrobin 25% . is the chemical of choice for disease management in these places; it is utilized  
272 100% of the time in Mandaulikhurad, Ratangarh, Ramgarh Manda, Badwali, and Bhateri. Mandauli Kalan,  
273 on the other hand, has a somewhat lower usage rate of 84%. Another frequent chemical is mancozeb,  
274 which is used at rates ranging from 60% to 65% in a number of villages, while propiconazol is used at  
275 rates ranging from 4% to 20%. Overall, the statistics show a 97.3% average heavy reliance on  
276 Tebuconazole 50%+ Trifloxystrobin 25% ., with Mancozeb and Propiconazol also playing key roles in  
277 sickness management in these diverse agricultural areas.

278

279

**Table 12. Common chemical control in Rupnagar district of Punjab**

Chemical used for diseases management (% of total farmers use)	Mandaulikh urad	Ratangarh	Ramgarh Manda	Badwali	Bhateri	Mandaulika lan	Overall
--	--------------------	-----------	------------------	---------	---------	-------------------	---------

(% of total farmers use)							
<b>Tebuconazole</b>	100	100	100	100	100	84	97.3
<b>50%+</b>							
<b>Trifloxystrobin</b>							
<b>25% .</b>							
<b>Mancozeb</b>	60	65	64	60	36	40	51.2
<b>Propiconazol</b>	13.3	15	20	6.7	4	4	10.5

280

281

### 282 3.9. YIELD

#### 283 3.9.1. Yield of Wheat

284 The data reveals the distribution of wheat yield per hectare across six villages, including Mandauli  
 285 Khurad, Ratangarh, Ramgarh Manda, Badwali, Bhateri, and Mandauli Kalan. It shows that the majority of  
 286 wheat yields in the "37-50q" and "51-62q" categories are concentrated in most of the villages, with  
 287 Mandauli Kalan standing out for its high yield in the "51-62q" category. However, in the "More than 62q"  
 288 category, the yield is relatively low across all villages, with Bhateri having the highest percentage. The  
 289 overall average wheat yield in all six villages falls into the "51-62q" category (Table 13).

290

291

**Table 13. Yield of wheat in different villages of rupnagar**

S. No.	Wheat yield (Quintals/hect.)	Mandauli Khurad	Ratangarh	Ramgarh Manda	Badwali	Bhateri	Mandauli Kalan	Overall
1.	37-50	40	50	44	46.7	36	40	<b>43</b>
2.	51-62	53.3	55	48	53.3	52	60	<b>54</b>
3.	More than 62	6.7	5	8	0	12	0	<b>3.6</b>

292

#### 293 3.9.2. Yield of Rice

294 (Table 14)In the "37-50" quintals/hec. category, Mandauli Khurad, Ramgarh Manda, and Mandauli Kalan  
 295 have the highest percentages of yield, while in the "51-62" category, Ratangarh, Bhateri, and Ramgarh  
 296 Manda lead. The overall average rice yield leans towards the "37-50" category, with a slight majority at  
 297 51% for that range.

298

299 **Table 14. Yield of rice in different villages**

S. No.	Rice yield (% of total farmers get)	Mandaulikhurad	Ratangarh	Ramgarh Manda	Badwalia	Bhateri	Mandaulikal	Overall
1.	37-50	53.3	50	52	46.7	48	56	<b>51</b>
2.	51-62	46.7	50	48	53.3	52	44	<b>49</b>

300 **4. CONCLUSION**

301 In conclusion, our research provided light on crucial farming methods and challenges in Rupnagar  
 302 District of Punjab. The findings highlighted the many crop types that are cultivated, the diverse seed  
 303 rates, and the relevance of mechanization. Farmers employed sophisticated nutrient management  
 304 techniques customized to their unique agroecological conditions. The study's mixed-methods design  
 305 ensured good data and allowed for a thorough comprehension. Pest control and water scarcity were  
 306 identified as critical issues. Among the recommendations are personalized extension services, technology  
 307 dissemination, and neighborhood-based water conservation projects. Addressing these concerns is  
 308 crucial in order to develop sustainable agriculture in the area, emphasizing the importance of context-  
 309 specific solutions. Future research should concentrate on the socioeconomic issues that influence  
 310 farming.

311

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321

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