# A COMPARATIVE ANALYSIS OF AGRONOMIC PRACTICES FOLLOWED IN FATEHGARH SAHIB RUPNAGAR DISTRICT OF PUNJAB, INDIA.


## ABSTRACT

To study about a comparative analysis of agronomic practices by farmer at a grass root level. The study aims to understand and improve agricultural sustainability and productivity in those reason by examining the crop cultivation, soil management water uses methods ,challenges and opportunities in local farming. This research contributes to the development of more efficient and environmentally friendly farming techniques the findings have the potential to enhance the livelihood of farmers and promote sustainable agriculture in this districts. This study is carried out under RAWE programme which was conducted by Department of University Institute of Agriculture Science (UIAS) Chandigharh University Mohali Punjab between August 2023 and September 2023. This research delves into the agronomic practices followed by the respondent of Fatehgarh Sahib and Rupnagar district of Punjab. The survey data is collected from the six villages i.e Chhoti Mandauli, Rattangarh, Ramgarh Manda, Bhadwali, Bhateri and Bari Mandauli. The main crops are grown in area Paddy (100%), Wheat (98.46%), Maize (29.23%) and Sugarcane (30%). The source of irrigation is tube well and source of seed is mainly from input dealers. Almost farmers are not using recommended dose of fertilizer and Urea (100%) is excessively applied in the field. *Echinochloacrusgalli* is the major concern of the farmers almost 100 percentage during the kharif Season in Paddy. *Phalaris minor* is the major problem of all the respondents 100 percentage in rabi season. Chemical method is used by farmers to overcome from weed. Average approximate yield of paddy is 74.92 quintals per hectare, wheat is 53.66 quintals per hectare and in case of sugar cane 296.6 quintals per hectare. In post-harvest management, mostly all farmers sell their produces and keep few quintals for self consumption. After had an interaction with farmers their agronomic practices management was sustainability and productivity.



**Keywords**- *Agriculture; agronomic practices; cultivation; crops; production; yield.*


## INTRODUCTION

Agriculture is often deemed a “national security” priority by Countries[1]. India is one of the major players in the agriculture sector worldwide and it is the primary source of livelihood for ~55% of India’s population. India has the world's largest cattle herd (buffaloes), the largest

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area planted for wheat, rice, and cotton, and is the largest producer of milk, pulses, and spices in the world. It is the second-largest producer of fruit, vegetables, tea, farmed fish, cotton, sugarcane, wheat, rice, cotton, and sugar. The agriculture sector in India holds the record for second-largest agricultural land in the world generating employment for about half of the country's population. Thus, farmers become an integral part of the sector to provide us with a means of sustenance[2]. Agriculture holds a significant place in the Indian economy, with over 70% of rural households relying on it for their livelihoods. As a critical sector of the Indian economy, agriculture contributes around 17% to the total GDP and provides employment for approximately 58% of the population[3] and Agriculture is a primary source of livelihood for at least two-thirds of the working population in India. Other sectors have not been able to provide enough employment opportunities for the growing workforce[3].

According to some scientists agriculture was widespread in the Indian peninsula, 10000–3000 years ago, well beyond the fertile plains of the north. For example, one study reports 12 sites in the southern Indian states of Tamil Nadu, Andhra Pradesh and Karnataka providing clear evidence of agriculture of pulses *Vignaradiata* and *Macrotylomauniflorum*, millet-grasses (*Brachiariaramosa* and *Setariaverticillata*), wheats (*Triticumdicoccum*, *Triticum durum/aestivum*), barley (*Hordeumvulgare*), hyacinth bean (*Lablab purpureus*), sorghum (*Sorghum bicolor*), pearl millet (*Pennisetumglaucum*), finger millet (*Eleusinecoracana*), cotton (*Gossypium sp*.), linseed (*Linum sp*.), as well as gathered fruits of ziziphus and two cucurbitaceae[4][5].

India adopted significant policy reforms focused on the goal of food grain self-sufficiency. This ushered in India's Green Revolution. It began with the decision to adopt superior yielding, disease resistant wheat varieties in combination with better farming knowledge to improve productivity. The state of Punjab led India's green revolution and earned the distinction of being the country's breadbasket[6]. The Green Revolution yielded great economic prosperity during its early years. In Punjab, where it was first introduced, the Green Revolution led to significant increases in the state's agricultural output, supporting India's overall economy. By 1970, Punjab was producing 70% of the country's total food grains,[7]and farmers' incomes were increasing by over[7]. Punjab's prosperity following the Green Revolution became a model to which other states aspired to reach[8]. Agronomical practices are directly proportional to the yield of the crop. In order to obtain good yield farmers must follow best agronomical practices according to the season and agro-climatic zone. These practices vary from region to region. There are 6 agroclimatic zones in Punjab. Fatehgarh Sahib and Rupnagar districtcomes under the Undulating plain zone, where temperatures are cold, humid to sub-humid, and semi-arid to humid. Rainfall varies between 165mm to 1000 mm. The soil of this area is suitable to grow vegetables, wheat, maize, paddy, sugarcane, and sorghum etc[9].

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Farmers were interviewed according to the RAWE programme about the basic agronomic practices which they followed from sowing to harvesting in this region. We also observed the changes in agronomic practices, the respondent adopted the combined methods for the better yields, they try to follow both the traditional as well as the modern methods. By this they put a step towards enhancing agricultural sustainability and productivity. The main objectives of the research are to examine the current agronomic practices at a grass root level followed in the region, to facilitate the sharing of knowledge and best practice among local farmers, exploring opportunities and challenges for improvement in the agronomic practices and enhancing agricultural sustainability and productivity.

## 2. MATERIALS AND METHOD


**Fig.1. The location of the region where the survey was conducted**


**Fig. 2. Shows the satellite map view of the six mentioned villages**

Thestudy was performed in Chamkaur Sahib tehsil of Rupnahar district and BassiPthana teh Fatehgarh Sahibdistrictof Punjab, India. The total 130 farmer were intreviwed on random bas fromthesixselectedvillagesi.eChhoti Mandauli,Rattangarh, Ramgarh Manda ,Bhadwali, Bhateri ar Bari Mandauli The above figure (1) shows the location of the region where the survey was conducte and (2) shows the satellite map view of the six mentioned villages[12][13]. The data was collected individually from respondent on the basis of well-prepared questionnaire about socio profi agronomic practices and plant protection followed throughout the year. The data collection was done by personal interview or a face-to-face interview by asking each parameter appropriately in sequence. The objective was to survey at the grassroot level. After collection of data from the respondents, each of the particulars were graded, analyzed and represented with the help of more appropriate analytical scale like figure, table, percentage and graphically by pie chart, column chart and doughnut chart.

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### 2.1 Total Number of farmers per village:

A total of 130 respondent were interviewed which among 15 respondent were from Chhoti Mandauli, 25 from Rattangarh , 20 from Ramgarh Manda and Bhadwali and 25 from Bhateri Bari Mandauli respectively. The below pie chart (graph 1) demonstrates the percentage of respondent selected from each village.

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**Table 1: Representing total number of farmers per village**

| S/N | Village | Overall farmer |
|---|---|---|
| 1 | Chhoti Mandauli | 15 |
| 2 | Rattangarh | 25 |
| 3 | Ramgarh Manda | 20 |
| 4 | Bhadwali | 20 |
| 5 | Bhateri | 25 |
| 6 | Bari Mandauli | 25 |



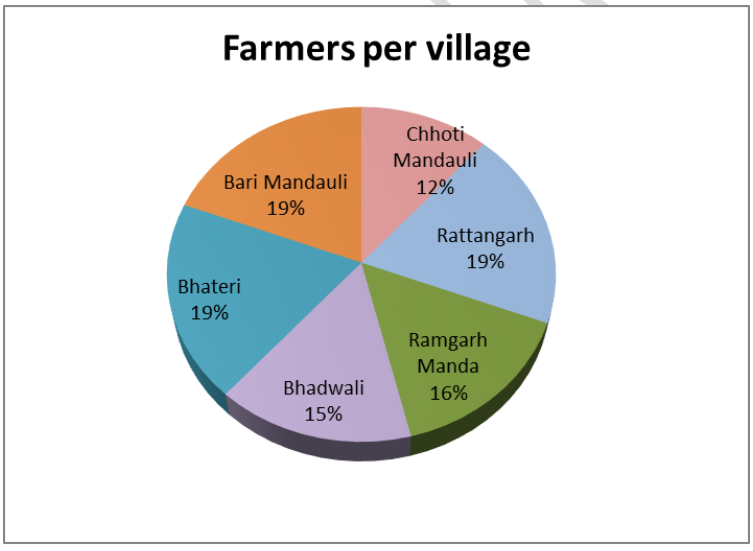


**Fig.3. Percentage of farmers per village.**

## 3. RESULTS AND DISCUSSION

Agronomic practices are vital important techniques and methods used in agriculture to optimize crop production and manage farming systems productively. These practices cover a huge range of activities and considerations, including soil management, crop selection, planting, cultivation, irrigation, pest and disease control, and harvesting. Agronomic practices can vary in different villages Chhoti Mandauli,Rattangarh, RamgarhManda ,Bhadwali, Bhateri and Bari Mandauli in state of Punjab based on the crops grown and the local conditions. After interviewed to a respondents we got to learn different agronomic practices followed in the season of kharif Paddy, Maize, cauliflower, Fodder crop Chari, oil seed Soybean and in the rabi wheat, mustard Fodder crop berseem crops are cultivated. Mainly Paddy and Wheat were widely cultivated, Fodder were grown by only who is doing practices of livestocks, at a small scale maize was grown for self and cattle consumption but sugarcane cultivation was done at commercial level and only in the village Bari Madauli soyabean crop was cultivated.

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### 3.1 Crops grown by the farmers

**Table 2: Representing crops grown by the farmers**

| S/N | Crops | Chhoti Mandauli (n=15) | Rattangarh (n=25 | Ramgarh Manda (n=20) | Bhadwali (n=20) | Bhateri (n=25) | Bari Mandauli (n=25) | Overall percantage (N=130) |
|---|---|---|---|---|---|---|---|---|
| 1 | Paddy | 15 | 25 | 20 | 20 | 25 | 25 | 130(100) |
| 2 | Wheat | 15 | 25 | 20 | 19 | 25 | 24 | 128(98.46) |
| 3 | Maize | 2 | 7 | 6 | 5 | 10 | 8 | 38(29.23) |
| 4 | Sugarcane | 5 | 8 | 8 | 5 | 6 | 7 | 39(30) |
| 5 | Berseem | 6 | 5 | 9 | 8 | 4 | 9 | 41(31.53) |
| 6 | Chari | 2 | 3 | 5 | 6 | 3 | 5 | 24(18.46) |
| 7 | Vegetables | 1 | 6 | 1 | 3 | 4 | 7 | 22(16.92) |

*Number (Percentage)

As we can observe in the above table (2), The practices of growing different crops opted by farmers in every season. Almost (100%) paddy and around (98%) wheat grow entire all villages in the field. While (29.23%) maize and (30%) sugarcane grow in the field. Apart from that fodder crops are grown which is berseem (31%) and chari around (19%) cultivated for livestock. At last vegetables are cultivated from some farmers around (17%) which include mainly growing Potato and Cauliflower.

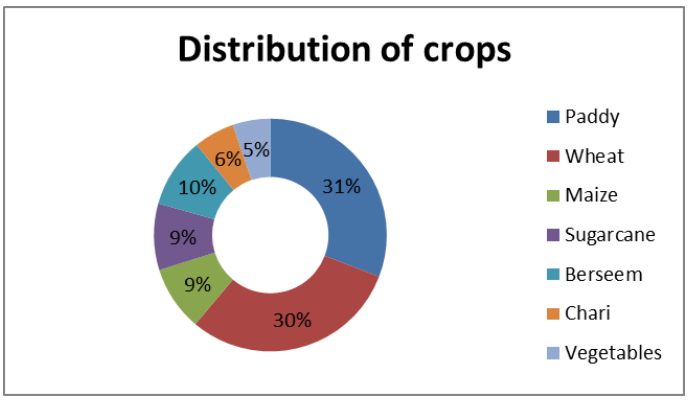


**Fig. 4. Depicts distribution of crops grown by villagers.**

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### 3.2 Crop varieties

#### 3.2.1 Paddy

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As the respondents responded, Paddy stands as the major crop cultivated in the fertile fields of Punjab. This staple plays a vital role. Farmers typically engage in two main varieties of rice i.e Basmati and non-basmati. The variety mostly grown in the selected villages are PR121, PR126, PR110 and Basmati 1121. Among these varieties PR126 is almost grown approx 96 percentage of the farmer while other varieties approximately PR121(21%), PR110(14%) and few of them cultivate Basmati 1121 (12.30%) among villages.

**Seed rate:** 20-25 kg seed per hectare

**Table 3. Representing paddy varieties grown by the respondents**

| S/N | Paddy Variety | Chhoti Mandauli (n=15) | Rattangarh (n=25 | Ramgarh Manda (n=20) | Bhadwali (n=20) | Bhateri (n=25) | Bari Mandauli (n=25) | Overall percentage (N=130) |
|---|---|---|---|---|---|---|---|---|
| 1 | PR126 | 15 | 24 | 20 | 19 | 22 | 23 | 125(96.15) |
| 2 | PR121 | 5 | 6 | 4 | 2 | 3 | 7 | 27(20.76) |
| 3 | PR110 | 3 | - | 5 | 3 | 3 | 4 | 18(13.84) |
| 4 | Basmati 1121 | 1 | 4 | 2 | - | 6 | 3 | 16(12.30) |

*Number (Percentage)

#### 3.2.2 Wheat

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After interviewed learned that the variety mostly grown in the selected villages are PBW550(badwal), PBW677, DWS777 and DWS222. Among these varieties PBW550 is almost grown approx 71% of the farmer while other varieties approximately PBW677 (20%),

DWS777 (14.61%), DWS222 (10.76%) and apart of these all varieties, other varieties are sown (7.6%) among villages by the farmers.

**Seed rate**: 100 kg/ha

**Table 4. Representing Wheat varieties grown by the respondents**

| S/N | Wheat Variety | Chhoti Mandauli (n=15) | Rattangarh (n=25 | Ramgarh Manda (n=20) | Bhadwali (n=20) | Bhateri (n=25) | Bari Mandauli (n=25) | Overall percentage (N=130) |
|---|---|---|---|---|---|---|---|---|
| 1 | PBW550 | 10 | 18 | 16 | 11 | 20 | 17 | 92(70.76) |
| 2 | PBW677 | 6 | 5 | 4 | 2 | 3 | 6 | 26(20) |
| 3 | DWS777 | 3 | 2 | 4 | 2 | 3 | 5 | 19(14.61) |
| 4 | DWS222 | 1 | 3 | 2 | - | 5 | 3 | 14(10.76) |
| 5 | Other Varieties | 2 | 1 | - | - | 4 | 2 | 10(7.6) |

*Number (Percentage)

**3.3 Source of seed**

Majority of the respondent farmers bought the seeds for cultivation from input dealers at Morinda which is the nearest town market and few of the farmers use their own seeds.

**3.4 Time of Sowing**

Mostly Crops that are sown are Paddy sown in the month of June-July and wheat crop sown in the month of that November-December.

**Table 5: Representing time of sowing of crops by the farmers**

| S/N | crops | Time of sowing |
|---|---|---|
| 1 | Paddy | June- July |
| 2 | Maize | June to July till August |
| 3 | wheat | November-December |
| 4 | Sugarcane | October- November |

**3.5 Method of Sowing**

Farmers of these villages are using different method of sowing for different crops like, broadcasting, transplanting, drilling and furrow method. As per the survey, 80 percentage farmers are broadcasting method (for wheat, barseem etc) 68 percentage farmers are using transplanting method (for rice), 48 percentage farmers are using ridge & furrow method

(sugarcane and vegetables like potato, cauliflower) and only 36 percentage farmers are using other method like dibbling, drilling etc.

**Table 6: Representing methods of sowing of crops by the respondents**

| S/N | Crops | Methods of sowing |
|---|---|---|
| 1 | Paddy | Broadcasting or transplanting |
| 2 | Wheat | Broadcasting or drilling like by seed drill or super seeder |
| 3 | Maize | Dibbling or drilling |
| 4 | Sugarcane | Ridge and furrow |

### 3.6 Land preparation

a) Ninety percentage of the respondent farmer used tractors to plough the land and the rest 10% used bullocks.

b) For crops ploughing of land is done 3-4 times.

**Table 7: Methods of ploughing**

| S/N | Methods of ploughing | Percentage |
|---|---|---|
| 1 | Animal Drawn plough | 10 |
| 2 | Machine drawn plough | 90 |

Small farmer having which have land holdings up to 2 hectares use animal drawn plough. Marginal and big farmers, which have land holdings of more than 4 hectares use machine drawn plough.

### 3.7 Seed Treatment

Most of the farmers were not treat their seeds. Small farmers, which have less land holdings and less knowledge treat the seeds by dipping it in normal water for a day. Marginal and big farmer treat seeds with chemical or used Hybrid seed. Seed treatment reduces the chance of infection of soil borne diseases and pests and lead to early germination.

### .3.8 Irrigation

**Table 8: Irrigation method and schedule of irrigation**

| 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 |

| | | | |
|---|---|---|---|
| Miaze | Tubewell | 4-5 times | 10-15 DAS |
| Sugarcane | Tubewell | 8 -10times | 45-55DAS |

### 3.9 Manure

In the case of organic manure, most of the respondents (farmers) used cow dung (gobar) and one or two of use green leaf manure. It is environment friendly, gives higher yield and contains high nutrient valve. In case of inorganic fertilizer, all respondents used Urea, Diammonium phosphate (DAP) and Murate of potash (MOP).

### 3.10 Fertilizer Dose of N:P: k applied by farmers

As the respondents were interviewed, we learnt that the most of farmers uses inorganic fertilizer Urea, DOP, and MOP (Table 9). In case of organic farmers prefer cow dung. A combination of inorganic and organic fertilizer helps to maintain soil health, keeps fertility alive. But as seen farmers was not aware of recommended dose of application of fertilizer it leads to imbalance in environmental. There was less use of MOP by farmers in the field. The recommended dose for the paddy crop is 125N: 30P: 30K[10] while recommended dose for the wheat is 120N: 60P: 40K[11].The most dependable fertilizer was urea and this could lead to threat increasing in PH of soil. This would give high but this could damage soil and lead to soil degradation.

### 3.11 Weed Observed

**Table 9: Weed found in major crops**

| S/N | Crop | Major weed Name | Overall percentage |
|---|---|---|---|
| 1 | Paddy | *Echinochloacrusgalli* | 100 |
| | | Cyperusrotundus | 80 |
| 2 | Wheat | *Phalaris minor* | 100 |
| | | *Avenaludoviciana* | 80 |
| 3 | Cauliflower | *Amaranthusviridis* | 30 |
| | | *Hook. F.* | |
| | | *Chenopodium album L* | 40 |
| 4 | Sugarcane | Cyperusrotundus | 60 |
| | | *Amaranthusviridis* | 45 |
| 5 | Maize | *Eleusineindica* | 34 |

As all the farmers face major problem in weeds in their fields through out the year, we can clearly see in the data collected (table 9). *Phalaris minor* is the major problem of all the respondents (100%). According to them this weed shows resistance towards most of the chemicals used to eradicate or eliminate this weed. It reduces the yield upto a significant level. This is the major concern of the farmers during the Rabi season especially in wheat crop as similar *Echino chloacrusgalli* is the major concern of the farmers almost (100%) during the Kharif Season in Paddy. In the sugarcane *Cyperusrotundus* weed about (60%) could be seen. *Eleusine indica* (34%) weed is found in maize crop. For weed management farmers use chemical method to control. Some pre-emergence herbicides pendimethalin and post-emergence herbicide butachlor.

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### 3.12 Harvesting Method

As per the data collected most of the farmers prefer combine harvester for the harvesting of the cereal crops such as wheat and paddy (table 11). As we know by mechanical method, it consumes less time and also does not require labour. About 90% respondents use combine harvester for the harvesting of wheat and paddy crop whereas only 10% of respondents go for manual harvesting. In case of paddy farmers generally prefer manual harvesting of varieties like Basmati,1121(PB 1121), Pusa basmati etc. as the grains of these varieties are long and thin. So, to avoid any damage to the grain's farmers do manual harvesting. And for harvesting maize they go manually. In case of sugarcane prefer manually harvesting most of the farmers.

**Table 10: Represting the methods of harvesrting adoped by the farmers**

| Crops | Methods of Harvesting |
|---|---|
| Paddy | Combine and harvester/ manually |
| Wheat | combiner and harvester |
| Maize | manually |
| Sugarcane | manually |

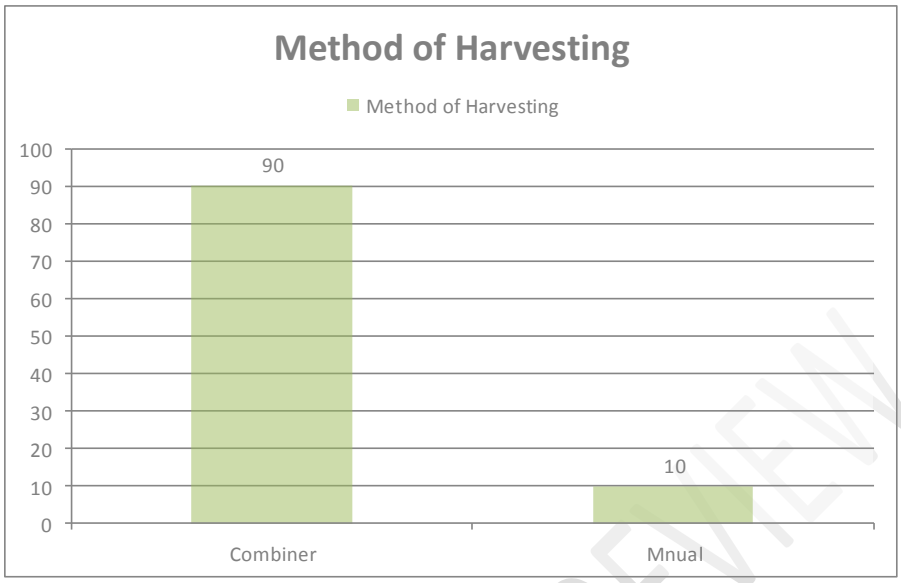


**Fig.5. Harvesting methods adopted by the farmers**

### 3. 13 Yield Record

Yield is an economical part of the any crops as can be seen the average yield of paddy is 74.92 quintals per hectare and average yield of wheat is 53.66 quintals per hectare (table 11). And in case of sugarcane the average yield is 296.6 quintals per hectare. The highest production of paddy among six villages are Badhwali had 77.5 QTLs/ha. and least production is 72.5 QTLs/ha of village Rattangarh. In case of Wheat production Bhateri has highest production 56 QTLs/ha and least production has 50 QTLs/ha of village Rattangarh. And of Sugarcane crop 310 QTLs/ha of the village Rattangarh has highest productivity rate and Chhoti Mandauli has least production yield is 280 QTLs/ha.

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**Table 11: Depicts the yield (qtl/ha) of cereals crops per villages**

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| S/N | Village | Paddy | Wheat | Sugarcane |
|---|---|---|---|---|
| 1 | Chhoti Mandauli | 74.5 | 55 | 280 |
| 2 | Rattangarh | 72.5 | 50 | 310 |
| 3 | Ramgarh Manda | 74 | 52 | 290 |
| 4 | Badhwali | 77.5 | 49 | - |
| 5 | Bhateri | 76 | 56 | 300 |
| 6 | Bari Mandauli | 75 | 54 | 303 |
| Overall (average/ha) | | 74.92 | 53.66 | 296.6 |

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**Table 12. Fertilizer dose Kg/hectare of N.P.K applied by the farmers**

| S/N | Fertilizers | Chhoti Mandauli (n=15) | Rattangarh (n=25) | Ramgarh Manda (n=20) | Bhadwali (n=20) | Bhateri (n=25) | Bari Mandauli (n=25) | Overall Kg/ha | Recommnded dose |
|---|---|---|---|---|---|---|---|---|---|
| Paddy | | | | | | | | | |
| 1 | Urea | 330 | 305 | 300 | 320 | 312 | 300 | 311.16 | 125 |
| 2 | DAP | 175 | 190 | 180 | 200 | 157 | 165 | 177.83 | 30 |
| 3 | MOP | - | - | - | - | - | - | - | 30 |
| Wheat | | | | | | | | | |
| 1 | Urea | 300 | 285 | 310 | 315 | 275 | 300 | 297.5 | 120 |
| 2 | DAP | 215 | 190 | 180 | 200 | 187 | 225 | 199.5 | 60 |
| 3 | MOP | - | - | - | - | - | - | | 40 |

*Overall kilogram per hectare data represents the mean value of fertilizers applied by the farmers in all the villages.

## 4. CONCLUSION

As per the survey data and conclusions , Paddy and wheat are more stable crops grown in the regions. Apart from these two cereals crops maize, sugarcane, cauliflower, potato and in case of fodder chari and berseem are preferred for livestock. The variety which is sown in these areas are PR-126 of Paddy and PBW550 of wheat approximately above 90% of farmers prefer. The source of seeds is mainly from the input dealers. Land preparation is the process of preparing the land for seedling and plantation. Land preparation of field is done by mechanical method i.e tractor, disc harrow, leveller and so on by farmers. It controls weeds germination. The irrigation method is flood system in Paddy and wheat and source of irrigation is mainly tube well availability. Mostly farmer uses inorganic fertilizer at a not recommended dose. They were not aware of recommended dose of fertilizer should be applied. They are using in a surplus dose of Urea and DAP which making in an imbalance of soil management. There is only one source of organic fertilizer that is only a Cow dung. A farmer who have cattle they utilize cow dung in a field to maintain the soil fertility for a longer period of times. The major weed which is observed throughout the year is *Echinochloacrusgall* in a Paddy field about 100% and in wheat *Phalaris minor* is also 100% observed. To overcome this problem farmer prefer chemical method. The regularly cause of occurring of these weed seasonally is typical following of cropping pattern. Apart from these all harvesting of crops is mostly done by Combine harvester (90%). On an average yield of paddy is 74.92 quintals per hectare, wheat is 53.66 quintals per hectare and in case of sugar cane 296.6 quintals per hectare. There are some issues like most of farmers are not aware of leaf color chart which is used to determine the N fertilizer needs of Paddy crops. Due to this they use excessive Urea fertilizer which lead to imbalance of nutrient management of crop and too high cost of production. However, the following same cropping pattern causes the pest and diseases problem in the every season to break chain of these pathogen go with proper cropping rotation. Before the preparation of the field farmers should visit for the their soil testing and cultivate the crop according to a weather forecasting which help them to choice of crop need to grow and prevent them from economical losses and make them to achieve high production of the produces.

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12.Anonymous,Available"https://www.researchgate.net/figure/Location-of-the-Study-area-Rupnagar-Punjab-India_fig1_258885321"

13.Anonymous,Available"https://www.researchgate.net/profile/Joydeep-Mukherjee-5/publication/258885321/figure/fig1/AS:669017559797764@1536517624296/Location-of-

the-Study-area-Rupnagar-Punjab-India.png" alt="Location of the Study area, Rupnagar, Punjab, India."