



# Adoption Status of Improved Rice Varieties and Fertilizer Use in Sri Muktsar Sahib District of Punjab

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## ABSTRACT

Rice is major food crop having significance for millions of farmers. It is grown under rice wheat cropping system on vast area in the Indo- Gangetic Plains (IGPs) of India. In Punjab state continuous need was felt to increase area under short duration recommended rice varieties for better crop yield and to save irrigation water. Adoption of these short duration recommended varieties and optimal fertilizer use are major factors that can contribute to enhanced rice productivity in short time span. Periodic data collected from 340 farmers from 2013-14 to 2017-2018 revealed that extent of adoption of improved rice and basmati varieties increased during the survey period. Majority of the farmers were applying excessive fertilizer-N doses to rice crops. Large number of farmers skips phosphorus application to rice and basmati and majority (78%) did not apply potash fertilizers. The data on adoption status may help the extension agencies to focus on bridging the gap to enhance yield of rice and basmati and thus, income of farmers along with conservation of natural resources.

**Key Words:** Adoption, Fertilizer, Improved, Rice, Status, Variety.

## INTRODUCTION

Rice (*Oryza sativa* L.) and wheat (*Triticum aestivum* L.) are the major food crops in the world. More than 60 per cent of the cultivable area of the Indian Punjab State is under rice cultivation during the *kharif* season. Therefore, it is imperative that rice production continue to sustain the ever growing population. Increase in agricultural production with limited resources could be possible by shifting more area under less input intensive crops and achieving higher crop yield per unit area (Godfray *et al*, 2010). The adoption of recommended improved varieties and production technologies are thus of utmost importance. Significant increase in yield of rice has been achieved with adoption of recommended technologies. Adoption of improved rice varieties has resulted in increase in production of rice (Singh *et al*, 2018, Manan *et al*, 2018). Rice is grown in rice-wheat cropping system and this cropping system occupies more than 26Mha of cultivated land and vast area (~10 Mha) in the Indo-Gangetic Plains (IGPs) of India (Singh *et al*, 2019). Rice

productivity varies widely depending on climatic conditions, water availability, soil fertility, fertilizer applied and other technology factors. Along with improved rice varieties fertilizer use is one of the key factors for the increase in rice production. Efficient nutrient management in rice has assumed great importance of high production levels of rice varieties (Smith *et al*, 1987). Therefore, the present study was conducted to assess the adoption status of improved varieties and fertilizer use practices in Sri Muktsar Sahib district of Punjab.

## MATERIALS AND METHODS

The total geographical area of district Muktsar is 2.63 lakh ha with 2.42 lakh ha cultivable area. Net irrigated area of the district is 2.2 lakh ha. and cropping intensity 175 per cent. The four blocks namely Muktsar, Malout, Gidderbaha and Lambi have 236 villages. Blocks Lambi and Gidderbaha of the district are un-irrigated. About 95 per cent area of district is irrigated through canal and rest of area through tube-wells. Cotton, rice, moong etc.

are major kharif crops while wheat, barley, raya and gram are major rabi crops.

The study was conducted in the Sri Muktsar Sahib district of Punjab. Data were collected from randomly selected 340 farmers through questionnaire using interview method. The data were collected from the year 2013-14 to 2017-18 following simple random method. For the collection of data, pre-tested questionnaire was used. The information regarding varieties grown and fertilizer used was collected from the farmers of all the four administrative blocks. From each block, five villages were randomly selected through checklist method from each village, four farmers were selected.

## RESULTS AND DISCUSSION

### Socio-personal characteristics of the farmers

The results of the study showed that majority of the farmers (51.5%) were above the age of 45 yr. The education level of about one third of the respondent (35.5%) was up to middle followed by matriculation (29.4%) senior secondary (11.8%), graduation (6.5%) and illiterate (5.5%). The family size of majority (60.0%) was 5-8 members, however, about one third (29.4%) were having family size >8 members. In most of the sampled farmers the family member involved in farming were numbered at two.

### Adoption status of improved rice varieties

#### Transplantation times for rice

Transplantation of rice starts in mid of June month. Very negligible area (0.34%) was transplanted

**Table 1: Socio-personal characteristic of the farmers in Sri Mukatsar Sahib district of Punjab.**

Characteristics	Frequency	Percentage
<b>Age of the respondent farmer</b>		
<25 yr	12	3.5
25-35 yr	42	12.4
35-45 yr	111	32.6
>45 yr	175	51.5
<b>Family size</b>		
1-4	35	10.3
5-8	204	60.0
>8	101	29.7
<b>Family members involvement in agriculture</b>		
One	92	27.1
Two	150	44.1
Three	98	28.8
<b>Education</b>		
Illiterate	18	5.3
Upto middle	120	35.3
Upto matric	100	29.4
Senior secondary	40	11.8
Graduation	22	6.5

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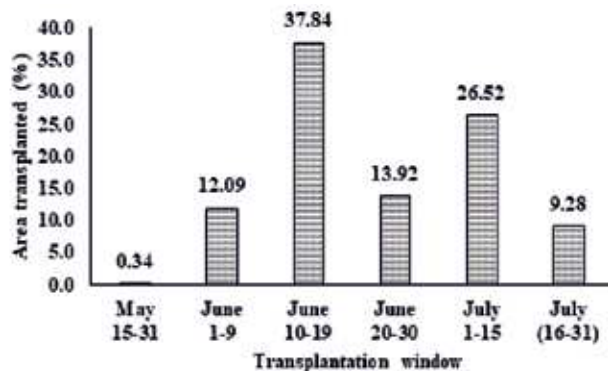
**Table 2. Percentage shift in area under recommended paddy varieties over the years.**

Rice variety	Year wise percentage shift in area				
	2013-14	2014-15	2015-16	2016-17	2017-18
Recommended					
PR 111	5.86	4.12	6.61	1.92	0.00
PR 114	3.84	1.22	0.20	5.24	6.15
PR 116	0.60	2.29	0.66	0.76	0.00
PR 118	2.74	2.44	3.16	3.47	2.68
PR 121	2.92	2.90	2.40	5.87	12.4
PR 122	8.12	3.21	1.35	4.16	7.43
PR 123	0.00	3.36	3.88	3.12	0.00
PR 124	0.00	0.00	19.25	4.42	0.00
PR 126	0.00	0.00	0.00	0.00	7.92
Total (A)	24.08	19.54	37.51	28.96	36.58
Un-recommended					
Pusa 44	4.34	1.68	4.24	9.50	18.75
Dogar Pusa	0.00	0.00	0.00	3.34	1.28
Golden 666	0.00	0.00	0.79	2.08	0.00
HKR 127	0.00	0.61	0.00	0.00	0.00
HKR 47	0.55	0.00	0.59	0.00	0.00
Hybrid 257	1.47	0.92	0.00	0.76	0.00
27P31	0.00	7.94	3.16	6.40	2.95
Total (B)	6.36	11.15	8.78	22.08	22.98
Recommended Basmati					
Pusa Basmati 1121	64.62	44.43	42.38	47.07	39.73
Pusa Basmati 1509	2.75	7.25	4.74	0.00	0.00
PB 3	0.40	6.72	0.00	0.00	0.00
Total (C)	67.77	58.4	47.12	47.07	39.73
Un-recommended					
Pusa 1401	1.79	10.92	6.32	1.89	0.72
Lajwab 111	0.00	0.00	0.26	0.00	0.00
Total (D)	1.79	10.92	6.58	1.89	0.72
Area shift in non-basmati rice (A+B)	30.44	30.69	46.29	51.04	59.56
Area shift in basmati rice (C+D)	69.56	69.32	53.7	48.96	40.45

**Table 3. Extent of adoption of improved rice varieties and basmati rice in Sri Muktsar Sahib district of Punjab.**

Particular	2013-14	2014-15	2015-16	2016-17	2017-18
Total area surveyed (ha)	1825	1655	1519	1576	1528
Area under IRV (ha)	483	428	547	570	618
Extent of adoption of improved rice varieties	0.26	0.26	0.36	0.36	0.40
Extent of adoption improved basmati rice	0.56	0.58	0.55	0.60	0.68
Overall extent of adoption	0.41	0.42	0.46	0.48	0.54

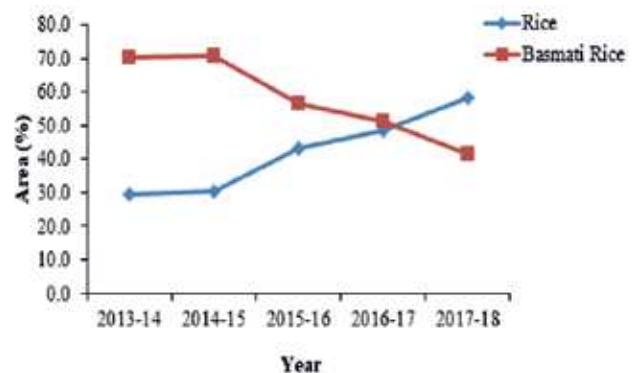
before 10<sup>th</sup> of June each year (Fig. 1). A large share of area under rice (37.84%) was transplanted between 10-19<sup>th</sup> of June. In case of basmati rice, a large share of area (26.52%) was transplanted between 1-15<sup>th</sup> of July. Rice transplantation before recommended time was practiced in the areas having water logging problem. Among basmati rice varieties, Pusa 1121 had highest area (~39.45 - 64.62%) during different years. Majority of the farmers had also adopted the recommended transplantation time i.e. second fortnight of June (Fig: 1).. Singh *et al* (2018) also reported that rice nursery is transplanted in the puddled field after 15<sup>th</sup> of June in Punjab, India. In case of rice, highest area was transplanted between 10-20<sup>th</sup> of June (37.94%) and while in case of basmati rice highest area was transplanted between 1-15<sup>th</sup> of July (26.52%)

**Fig: 1.** Percent area transplanted during different intervals

### Shift in area under rice varieties

The results of the study show that nearly 65 per cent of the total paddy area was under Pusa Basmati 121 during 2013-14 which reduced to 39.73 in 2017-18 (Table 2). In totality area wise

proportion of basmati rice decreased from 69.56 per cent during 2013-14 to 40.45 per cent during 2017-18. On the contrary, area under non-basmati rice increased from 30.44 to 59.56 per cent. The area under different improved rice varieties (IRV) varied increased 24.08 to 36.58 per cent from 2013-14 to 2017-18. However, area under un-recommended non-basmati varieties was also increased. Area under un-recommended non-basmati varieties increased from 6.36 per cent during 2013-14 to 22.98 per cent during 2017-18. The increase in area under un-recommended rice varieties may be due to poor quality underground water where farmers prefer un-recommended rice hybrids. Among the IRV, maximum per cent rise in area was observed in case of PR 121 (2.92 to 12.4%) followed by PR 114 (3.84 to 6.15%) and PR 126 (0 to 7.92%) in a span of five years. Among un-recommended non-basmati varieties area under Pusa 44 variety increased from 4.34 to 18.75 per cent.

**Fig :2.** Temporal trends of change in area (%) under rice and basmati rice in Sri Mukatsar Sahib district, Punjab

The extent of adoption of improved varieties of rice varied between 0.26 and 0.40, while for basmati

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**Table 4. Percentage distribution of farmers according to extent of nitrogen fertilizer use in rice and basmati rice in Muktsar district of Punjab**

A. Extent of Nitrogen use in rice					
Dose of Nitrogen (kg/ha)	Per cent farmers				
	2013-14	2014-15	2015-16	2016-17	2017-18
87.5-112.5	0	3	0	2	2
112.5-137.5	26	34	35	35	38
137.5-162.5	48	48	49	42	40
162.5-187.5	26	15	17	21	20
B. Extent of Nitrogen use in basmati					
37.5-62.5	3		9	12	15
62.5-87.5	13	10	17	16	20
87.5-112.5	55	34	40	25	25
112.5-137.5	16	48	26	39	40
137.5-162.5	13	8	8	7	0
162.5-187.5	0	0	0	2	0

rice it varied between 0.56 and 0.68 (Table 2). Singh *et al* (2017) reported that nearly 78-94 per cent of the farmers were growing recommended varieties in case of wheat crop in south-wertern Punjab.

### **Fertilizer use**

It was found that majority (40-49%) of the rice farmers were applying fertilizer N in the range of 137.5-162.5 kg N/ha during different years of survey period, while 26-38 per cent of the farmers were applying fertilizer in the range of 112.5-137.5 kg/ N ha. Earlier, Singh *et al* (2018) also reported that about 45-50 per cent of traditional rice growers were applying fertilizer-N < 162.5 kg N/ ha

The application of fertilizer N in case of basmati rice was in the range of 87.5-137.5 kg N/ha for majority of the farmers. Majority of the farmers were applying fertilizer N in excess to basmati during initial years of survey which declined over the years (Table 4). Majority of the farmers were applying fertilizer N in excess to basmati during initial years of survey which declined over the years.

It was evident from the data (Table 5) that there was rise in proportion (26% to 57%) of farmers in span of five years which discontinued the practice of applying phosphorus to the rice crop. There were 13 per cent of farmers applying 12.5 - 37.5 kg P<sub>2</sub>O<sub>5</sub> /ha. Only 5 per cent of the farmers were applying P in range of 37.5-50 kg/ha. Kaur and Sharma (2017) reported that small farmers were using fertilizers more optimally than medium and large farmers in the state. This scenario was found to be same in all the zones.

In case of basmati crop, discontinuance of the practice of applying phosphorus in span of five years increased in proportion from 19 of the farmers to 62 per cent. The proportion of farmers applying fertilizer-P upto 50 kg/ ha was ~7.0 per cent only. This shows that extension efforts were successful in convincing farmers to skip the dose of fertilizer-P in case recommended dose has already been applied to rabi season crop.

**Table 5. Percentage distribution of farmers according to extent of phosphorus fertilizer use in rice and basmati rice in Muktsar district of Punjab**

<b>A. Extent of Phosphorus use in rice</b>					
<b>Dose of phosphorus (kg/ha)</b>	<b>Percentage of farmers over years</b>				
	<b>2013-14</b>	<b>2014-15</b>	<b>2015-16</b>	<b>2016-17</b>	<b>2017-18</b>
Nil	26	44	51	57	57
12.5-25	0	8	40	13	8
25-37.5	64	36	2	28	30
37.5-50	4	8	5	2	5
50-62.5	6	4	2	0	0
<b>B. Extent of Phosphorus use in rice</b>					
Nil	19	50	45	72	62
12.5-25	0	14	47	9	5
25-37.5	71	30	0	19	27
37.5-50	3	2	8	0	7
50-62.5	3	4	0	0	0
62.5-75.0	3	0	0	0	0

**Table 6. Percentage distribution of farmers according to extent of Potash fertilizer use in rice and basmati rice in Muktsar district of Punjab .**

<b>A. Extent of Potash fertilizer used in rice</b>					
<b>Dose of Potash (kg/ha)</b>	<b>Percentage of farmers over years</b>				
	<b>2013-14</b>	<b>2014-15</b>	<b>2015-16</b>	<b>2016-17</b>	<b>2017-18</b>
Nil	82	86	64	69	79
5-10	2	2	6	8	7
10-15	8	12	13	6	8
15-20	6	0	4	18	7
20-25	0	0	13	0	0
25-30	2	0	2	0	0
<b>B. Extent of Potash fertilizer used in basmati rice</b>					
Nil	81	92	45	72	87
5-10	0	0	47	9	0
10-15	0	0	0	19	0
15-20	6	8	8	0	13
20-25	10	0	0	0	0
25-30	3	0	0	0	0

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Use of fertilizer-K in rice crop is recommended based on soil test report as this nutrient generally found available in soils to meet crop needs. The results given in Table 6 show that majority of the farmers (79%) were not applying K-fertilizers to the rice as well as basmati rice crop (87%), while rest of the farmers were applying fertilizer-K in different doses ranging from 5-20 kg/ ha. The micronutrient deficiencies reported by farmers were related to Fe and Zn, however, on small scale. Bell and Dell (2008) reported that deficiency of micro-nutrients has become a constraint to productivity, stability and sustainability of soils. Thus, majority of farmers were following recommend practices with aspect to fertilizer use. Kumar (2013) reported that in case of wheat crop 32 per cent farmers fully adopted recommended practices while 24.9 per cent partially adopted recommended practices. Earlier, Bhowate and Olambe (2017) reported that recommended fertilizer use resulted in enhanced wheat yields.

### CONCLUSION

Status of crop production practices revealed a great deal regarding adoption status of recommended varieties and fertilizer use practices among rice farmers. The study on farmer practice can generate great deal of information regarding adoption gaps and underlying reasons. The extension agencies can use this information to reduce adoption gaps by educating farmers regarding balanced use fertilizer and importance of improved crop varieties. However, there are various reasons at field level for over and excessive use of chemical fertilizers and cultivation of un-recommended crop varieties. The discussion with the farmers reveals various constraints in adoption of improved practices of crop production. Thus, reasons for lack of adoption of recommended crop varieties, sowing times, fertilizers, insecticides etc. may be technical, institutional or socio-economic. Further, analysis of constraints in adoption of scientific recommendations may lead bridge yield gaps leading to socio-economic development of the farmers.

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