International Journal of Agricultural Sciences ☞DOI:10.15740/HAS/IJAS/15.2/297-301
Volume 15 | Issue 2 | June, 2019 | 297-301 ■ ISSN : 0973-130X Visit us : *www.researchjournal.co.in*

***RESEARCH PAPER***

# Impact of direct seeded rice basmati for resource conservation in Muktsar district of Punjab

Balkaran Singh Sandhu* **and** Nirmaljit Singh Dhaliwal
Krishi Vigyan Kendra, Sri Muktsar Sahib (Punjab) India (Email: balkaransandhu@pau.edu)

**Abstract :** Farmers field demonstrations were conducted during 2015 to find out the best suitable cluster for direct seeded basmati rice in district Sri Muktsar Sahib in SW Punjab. The district was divided into six clusters and demonstrations were equally divided into these clusters. Out of the six different clusters, cluster-I (54.08 q/ha) produced significantly higher grain yield from direct seeded basmati, which was statistically at par with cluster-IV (52.25 q/ha), cluster-V (50.42 q/ha) and cluster-III (48.25 q/ha) but significantly higher from cluster-VI (44.79 q/ha) and cluster-II (43.0 q/ha). Whereas, average grain yield of direct seeded basmati was decreased by 6.7 per cent as compared to transplanted basmati. However, higher net return was obtained from cluster-I followed by cluster-IV, cluster-V and cluster-VI, but less net return was obtained in cluster-II and cluster-III under both planting methods. Higher net returns were due to lower input-cost among these clusters. Average net return was also higher under transplanted basmati from direct seeded basmati but average benefit-cost ratio was higher in direct seeded basmati (2.86:1) as compared to transplanted basmati (2.70:1). Cluster-I, cluster-III, cluster-IV and cluster-V produced higher B:C ratio under direct seeded basmati from transplanted basmati. But in cluster II and cluster VI, B:C ratio under direct seeded basmati decrease from transplanted basmati. So direct seeded basmati performed well and well suitable in cluster-I, cluster-III, cluster-IV and cluster-V and didn't perform well in cluster II and cluster VI. In these two clusters transplanted basmati can be preferred.

**Key Words :** Basmati, Benefit-cost ratio, Conservation method, Direct seeding, Economics, Yield

**View Point Article :** Sandhu, Balkaran Singh and Dhaliwal, Nirmaljit Singh (2019). Impact of direct seeded rice basmati for resource conservation in Muktsar district of Punjab. *Internat.J.agric.Sci.*, **15** (2) : 297-301, **DOI:10.15740/HAS/IJAS/15.2/297-301.** Copyright@2019: Hind Agri-Horticultural Society.

**Article History : Received :** 28.04.2019; **Revised :** 15.05.2019; **Accepted :** 24.05.2019

## INTRODUCTION

Rice (*Oryza sativa* L.) is most important staple food of about half of the world population and also a major source of calories for approximate 60 per cent of the world population (Biswas and Bhattacharya, 2013). During 2015-16 in Punjab, rice is a major *Kharif* crop on an area of about 2.89 million hectare with a total production of 11.11 million tonnes of rice (Anonymous, 2016). Rice feeds about 20 per cent of the world population (Saharawat *et al.*, 2010). Now-a-days growth in productivity of rice-wheat systems declines in India and it also degrade the soil and water resources and threatening the sustainability of system ( Duxbury *et al.*, 2000; Kumar and Yadav, 2001; Kumar *et al.*, 2015 and Ladha *et al.*, 2003). Over exploitation of ground water is major constraint to the sustainability of traditional

***Author for correspondence:**

system of the puddled transplanted rice in Indo-gangetic plains (Rodell *et al.*, 2009). Agriculture's share of freshwater is likely to be decline by 8–10 per cent because of increasing the competition from urban and industrial sectors (Seckler *et al.,* 1998). The groundwater is depleting at the rate of 4.0 cm per year in Punjab and Haryana (Yadav *et al.,* 2010). Transplanted rice requires continuous flooding (Farooq *et al*., 2011 and Walia *et al*., 2011). To meet the water crisis grow the rice with less water (Mahajan *et al*.,2004). In Punjab, transplanting is dependent upon the migrant labour, which is a major concern in transplant rice method. Unscheduled electricity power supply also adversely affects the farming practices. All these factors raise the cost of cultivation and delay the planting of crop. Therefore, the need of hour is to develop alternative systems that require less water (Kumar *et al*., 2015 and Saharawat *et al*., 2010).

Direct seeded rice (DSR) is a technique based on minimum soil disturbance and a good option of farming under rice-wheat cropping system (Singh *et al.*, 2012). With direct seeding of rice, seed is sown directly into field, eliminating the laborious process of transplanting of seedlings. It is the technology which has low labour cost, water saving, low soil degradation, energy efficient and eco-friendly characteristics (Chauhan *et al*., 2012; Giri, 1998; Kumar and Ladha, 2011; Mahajan *et al.*, 2009 and Yadav *et al*., 2010). Direct seeded basmati is very good technique for growing rice crop in those areas where water and labour shortage are major problems. In Punjab during *Kharif* 2014, the direct seeded rice/ basmati was cultivated on 1,12,000 hectare in the Punjab state. Out of this 29,000 ha was only in Sri Muktsar sahib district which consists the 25.9 per cent of total area of Punjab (Sandhu and Dhaliwal, 2015). But during *Kharif* 2015 the area under direct seeded basmati in the district is reduced to 22,000 ha. Keeping the above facts in view, the present study was undertaken with the objective to find out the best cluster/area suitable for direct seeding of rice in Sri Muktsar Sahib.

## MATERIAL AND METHODS

The study was conducted during *Kharif* 2015 by Krishi Vigyan Kendra, Sri Muktsar Sahib, Punjab on farmer's fields. The annual rainfall of the area is 382 mm, most of which is received during July to September (Anonymous, 2014). Sri Muktsar Sahib district is one of the major rice and cotton growing pockets of Punjab. In most of the area, ground water is not fit for irrigation but sufficient quantity of canal water is available. 36 demonstrations were equally divided into six different clusters. These clusters were formed on the bases of soil type and water availability in adjoining villages. In cluster-1 demonstrations were conducted in Bhullar village, in cluster-II demonstrations were conducted in Muktsar local, Balamgarh, Barkandi and Srianaga villages. In cluster-III, demonstrations were conducted in Kaoni, Gurri Sangar, Sangudhon and Khirkianwala village whereas, in cluster-IV, demonstrations were conducted in Chhattiana, Kothe dasmesh and Giljewala village. In cluster-V demonstrations were conducted in Bam village whereas, in cluster-VI demonstrations were conducted in Lalbai, Mehraj wala, Fulewala and Tharajwala villages. Out of these six clusters cluster-I and cluster-IV were the rice growing area and ground water quality is good in that area and adoption of direct seeded basmati is good among the farmers in that area. Cluster-III and cluster-VI are major cotton growing area and underground water quality in those experimental plots is not good for irrigation. Soil samples from each demonstration were collected and analyzed for pH, EC, OC (%), available P and K (Table A). Among all demonstrations, the soil texture was loamy sand to loam in all clusters. However, soil was medium in OC and available P and rich in available K in all the clusters of the district. The soil in cluster-II, cluster-III and cluster-VI was slightly alkaline and cluster-II and cluster-VI

**Table A : Soil characteristics of different clusters of the Sri Muktsar Sahib**

| District | pH | EC (dS $m^{-1}$) | OC (%) | P (kg/ha) | K (kg/ha) |
|---|---|---|---|---|---|
| Cluster-I | 8.26 | 0.448 | 0.43 | 20.5 | 975 |
| Cluster- II | 8.91 | 0.654 | 0.41 | 16 | 993.75 |
| Cluster- III | 9.17 | 1.148 | 0.41 | 20.5 | 818.75 |
| Cluster- IV | 8.62 | 0.463 | 0.4 | 15.5 | 837.5 |
| Cluster- V | 8.53 | 0.443 | 0.37 | 20 | 1012.5 |
| Cluster -VI | 8.96 | 1.022 | 0.41 | 13 | 681.25 |

having high EC among different demonstrations. After field preparation, Pusa basmati 1121 was directly sown by using seed cum fertilizer drill. Fertilizer were applied according to soil test basis. Recommended weed control method was applied and irrigations were applied according to the requirement of the crop. Yield data was collected through field observations. Gross return was calculated by multiplying yield with prevalent market rate of the basmati crop received by farmers. For obtaining input cost, the sum of expenditure on land preparation (cultivator @ Rs.250/-, disk harrow @ Rs.350/-, planking @ Rs. 150/-, puddling @ Rs.500/- per acre), planting method, fertilizer, insecticide, fungicide, herbicide, irrigation cost, labour, harvesting cost, etc. were calculated from each plot. Further net return and benefit-cost ratio were calculated from these data. Collected data were further analyzed by using Randomized Block Design.

## RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

### Grain yield and input cost:

Out of the six, cluster-I (54.08 q/ha) produced significantly higher grain yield, which was statistically at par with cluster-IV (52.25 q/ha), cluster-V (50.42 q/ha) and cluster-III (48.25 q/ha) but significantly higher from cluster-VI (44.79 q/ha) and cluster-II (43.0 q/ha) cluster. Among transplanted basmati all the different clusters failed to produce any significant effect on the grain yield of the basmati crop (Table 1). As we compared different sowing method, average grain yield among direct seeded basmati decreased by 6.7 per cent as compared to transplanted basmati. In cluster-I, transplanted basmati (55.58 q/ha) produced only 2.8 per cent higher grain yield than direct seeded basmati (54.08 q/ha). Similarly in cluster-III, cluster-IV and cluster-V decrease in yield was observed *i.e.* 1.5, 2.1 and 3.6 per cent, respectively (Table 1). However in cluster-II 17.2 per cent decrease in yield were reported among direct seeded basmati (43.0 q/ha) as compared to transplanted basmati (50.42 q/ha). Similarly in cluster-VI 16.1 per cent decreasing yield was recorded among direct seeded basmati as compared to transplanted basmati. Similar results were observed by Sidhu *et al*. (2014); Kumar *et al*. (2015) and Sandhu and Dhaliwal (2015) where higher grain yield were

**Table 1 : Grain yield and input cost of various clusters under different planting method of basmati crop**

| Name of the cluster | Yield (q/ha) | | % Change in yield | Input cost (Rs./ha) | | Average market price of crop (Rs./q) |
|---|---|---|---|---|---|---|
| | DSB* | PTB* | | DSB | PTB | |
| Cluster -I | 54.08 | 55.58 | -2.8 | 21770.8 | 25058.3 | 2085 |
| Cluster- II | 43.00 | 50.42 | -17.2 | 26050.0 | 28779.2 | 1762 |
| Cluster-III | 48.25 | 48.96 | -1.5 | 27883.3 | 28470.8 | 1779 |
| Cluster-IV | 52.25 | 53.33 | -2.1 | 25437.5 | 28133.3 | 2183 |
| Cluster-V | 50.42 | 52.25 | -3.6 | 27358.3 | 29820.8 | 2051 |
| Cluster-VI | 44.79 | 52.00 | -16.1 | 28008.3 | 30333.3 | 2100 |
| Average | 48.80 | 52.09 | -6.7 | 26084.7 | 28432.6 | 1993 |
| C.D. (P=0.05) | 6.9 | NS | - | - | - | - |

*DSB- Direct seeded basmati, PTB- Puddled transplanted basmati NS= Non-significant

**Table 2 : Net returns and benefit: Cost ratio under different planting methods of basmati crop**

| Name of the cluster | Gross returns (Rs.) | | Net returns (Rs.) | | Benefit: Cost ratio | |
|---|---|---|---|---|---|---|
| | DSB | PTB | DSB | PTB | DSB | PTB |
| Cluster-I | 112633 | 115817 | 90863 | 90758 | 4.17 | 3.62 |
| Cluster-II | 75462 | 88558 | 49412 | 59779 | 1.90 | 2.08 |
| Cluster- III | 85708 | 86950 | 57825 | 58479 | 2.07 | 2.05 |
| Cluster- IV | 114138 | 116542 | 88700 | 88408 | 3.49 | 3.14 |
| Cluster- V | 103849 | 107213 | 76491 | 77393 | 2.80 | 2.60 |
| Cluster- VI | 98283 | 109167 | 70275 | 78833 | 2.51 | 2.60 |
| Average | 98346 | 104041 | 72261 | 75608 | 2.77 | 2.66 |

recorded with transplanted rice as compared to direct seeded rice. Clusters II and VI are major cotton growing area of the district and ground water quality was also not good. So direct seeding is not suitable in these clusters.

However, higher input cost among direct seeded basmati was observed with cluster-VI (Rs. 28008.3/ha) and cluster-III (Rs. 27883.3/ha) followed by cluster-V (Rs. 27358.3/ha). Lowest input cost was observed cluster-I (Rs. 21770.8/ha) followed by cluster-IV (Rs. 25437.5/ha) and cluster-II (Rs. 26050/ha) cluster. Whereas, among transplanted basmati higher input cost was recorded with cluster-VI cluster and lower in cluster-I cluster (Table 1). As we considered about the comparison between these two planting methods, average input-cost of all the clusters under direct seeded basmati is 9.0 per cent lower from transplanted basmati. Sidhu *et al*. (2014) and Sandhu and Dhaliwal (2015) also reported the similar results where less input cost was recorded under direct seeded basmati from transplanted basmati.

**Net returns and benefit-cost ratio:**

Gross return was calculated by multiplying yield with prevalent market rate of the basmati crop. Higher gross return under direct seeded basmati was obtained in cluster-IV (Rs. 114138/ha) cluster followed by cluster-I (Rs. 112633/ha). Higher gross return was recorded due to higher grain yield and higher market price obtained by farmers of that cluster. Whereas lower gross returns were obtained in cluster-II (Rs. 75462/ha) and cluster-III (Rs. 85708/ha). Similarly, higher gross return was recorded under transplanted basmati in cluster-IV and cluster-I and lower in cluster-III and cluster-VI cluster (Table 2). Cluster-I produced higher net return (Rs. 90863/ha) under direct seeded basmati followed by cluster-IV (Rs. 88700/ha), cluster-V (Rs.76491/ha) and cluster-VI (Rs.70275/ha). Whereas, lower net return obtained under cluster-II (Rs. 49412/ha) and cluster-III (Rs. 57825/ha). Similarly net return under transplanted basmati was higher under cluster-IV and cluster-I and lower in cluster-II and cluster-III (Table 2). As we compared these two different planting methods in different clusters, cluster-I and cluster-IV produced higher net return among direct seeded basmati from transplanted basmati.

The average B:C ratio of all clusters, direct seeded basmati produced higher B:C ratio (2.77:1) from transplanted basmati (2.66:1). Among all the different clusters, cluster-I, cluster-III, cluster-IV and cluster-V produced higher B:C ratio under direct seeded basmati as compared to transplanted basmati (Table 2). Ganawar *et al*. (2008); Sidhu *et al*. (2014); Kumar *et al*. (2015) and Sandhu and Dhaliwal (2015) also recorded higher benefit: cost ratio with direct seeded rice as compared to transplanted rice. Whereas, cluster-II and cluster-VI, B: C ratio under direct seeded basmati lower from transplanted basmati (Table 2). Among direct seeded basmati, cluster-I produced higher (4.17:1) B:C ratio followed by cluster-IV (3.49:1), cluster-V (2.80:1) and cluster-VI (2.51:1). Lower B:C ratio was obtained from cluster-II (1.90:1) and cluster-III (2.07:1). However, from transplanted basmati higher B:C ratio was produced from cluster-I (3.62:1) followed by cluster-IV (3.14:1) followed by cluster-VI (2.60:1) and cluster-V (2.60:1). Lower B:C was obtained from cluster-III (2.05:1) and cluster-II (2.08:1).

**Conclusion:**

Direct seeded basmati performed well in cluster-I, cluster-III, cluster-IV, cluster-V thus sowing the suitability of the area for direct seeding. However, the results obtained from cluster-II and cluster-VI were not encouraging. In cluster-I and cluster-IV, adoption rate of direct seeded basmati is high and area is increasing. In cluster-III, overall performance of direct seeded basmati was satisfactory as compared to other clusters, but it performs better than transplanted basmati within the cluster. This area shifted from cotton to paddy and problem of aerobic weed resulted in lower yield. So, in this area (cluster-III) direct seeding may be increased with proper weed control. In cluster-II and cluster-VI very lower grain yield and B:C ratio was observed in direct seeded basmati. In these two clusters, the soil was not suitable for direct seeding and ground water quality was also not good among area. So, in these two clusters transplanted basmati can be preferred. Overall direct seeding is a labour saving technology but soil type, weed flora are important factor for its success. In new rice growing area it should be avoided and preference should be given to transplanted.

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