

Original Research Article

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Performance of Basmati Rice (*Oryza sativa* L.) under Different Transplanting Dates and Plant Spacings in South West Punjab

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ABSTRACT

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A field experiment entitled Performance of Basmati rice (*Oryza sativa* L.) under different transplanting dates and spacings was conducted at the Research Farm of Guru Kashi University, Talwandi Sabo during *kharif* season 2016. The experiment was laid out in split plot design comprising three transplanting dates (July 12, July 27 and August 11) in main plot and three spacings (25cm × 15cm, 20cm × 15cm and 15cm × 15cm) in sub-plot. The treatment combinations were replicated thrice. Results of field experiment revealed that early transplanting *i.e.* July 12 of basmati rice recorded significantly higher panicle length, number of grains per panicle, 1000-grain weight and grain yield. Similarly, sown rice in spacing of 20cm × 15cm gave significantly higher grain yield (46.8 q/ha) over the other two spacings. On the basis of experiment it is concluded that transplanting of rice seedlings on July 12 and spacing of 20cm × 15cm gave maximum yield of Basmati rice. The findings can be useful for improving productivity of Basmati rice in south western districts of Punjab.

Introduction

Rice (*Oryza sativa* L.) is one of the principle staple food for more than half of the world population. Rice is the major source of energy or calories especially in Asia, where more than two billion people are getting 60-70% of their energy requirement from rice and its derived products. It contains 6-12% protein, 70-80% carbohydrate, 1.2-2.0% mineral matter and considerable amount of fats and vitamins. Rice supplies 23% of global human per capita energy and 16% of per capita protein requirement.

Aromatic (Basmati) rice is known for its quality, aroma and demand in the domestic as well as in the international market. The major portion of rice area is devoted to the coarse and medium slender rice varieties, however very limited area is under the fine and scented rice varieties. Aromatic rice which has stronger aroma and kernel elongation than ordinary rice has more demand in different countries of the world (Bajpai and Singh, 2010).

Timely planting of basmati rice is an important factor in determining grain yield and quality parameters whereas delay in

transplanting has been found to influence the growth and yield of rice tremendously (Dhiman *et al.*, 1997). Spacing between plants plays an important role in exploiting yield potential of a variety. The yield potential is not exploited mainly due to inadequate plant population. Plant density or spacing plays an important role in yield maximization of rice (Siddiqui *et al.*, 1999). Different row spacing affected significantly the number of tiller per square meter. Optimum plant spacing ensures plants to grow properly with their aerial and underground parts by utilizing more solar radiation and nutrient. The maximum benefits in respect of rice yield can be obtained where planting is done with proper spacing (Sultana *et al.*, 2012).

Materials and Methods

A field experiment was conducted at Guru Kashi University, Talwandi Sabo, Bathinda during *khariif*, 2016 to study the effect of different transplanting dates and spacings on the performance of basmati rice variety Pusa Basmati 1121. The Treatments consisted of three transplanting dates *viz.* July 12, July 27 and August 11 and three spacings *viz.* 25cm x 15cm (S₁), 20cm x 15cm (S₂) and 15cm x 15cm (S₃). The experiment was laid out in split plot design with three replications, keeping transplanting dates in main plot and spacing in sub plot. Thirty days old seedlings were transplanted with three different spacings under observation. Weed management and plant protection measures were adopted as per the recommended package and practices. The crop was harvested and threshed as per schedule. The observations on plant height, number of productive tillers per hill, panicle length, number of grains per panicle, 1000 grain weight, grain yield and straw yield. Harvest index (HI) was calculated by using following formula:

$$\text{Harvest index (\%)} = \frac{\text{Grain yield}}{\text{Biological yield}} \times 100$$

Fisher's ANOVA technique and least significant difference (LSD) test at 5% probability level was used to compare differences among treatment means (Steel *et al.*, 1997).

Results and Discussion

Growth attributes

Different spacing had significant influence on plant height and no. of productive tillers (Table 1). However, among plant spacing S₃ (15×15cm) treatment recorded significantly higher plant height (105.9cm) but no. of productive tillers (15.9) were highest in spacing S₁ (25×15cm) as compared to other spacing. Om *et al.*, (1993) also reported that closer spacing (15cm × 15cm) recorded maximum grain yield of Basmati rice.

Growth parameters were varied significantly among the different transplanting dates. Early transplanting date *i.e.* July 12 (D₁) recorded significantly higher plant height (113.0 cm) and number of tillers/plant (19.6) as compared to late transplanting dates (July 27 and August 11). The present results were in agreement with Om Hari *et al.*, (1997) for plant height who also reported that early transplanting recorded higher yield than late transplanting.

Yield attributes

The yield components namely panicle length, no. of grains/panicle and test weight showed significant variation under different transplanting dates and spacings. Highest panicle length (25.3 cm), no. of grains/panicle (101.6) and test weight (28.5 g) was observed under spacing S₁ (25×15cm) as compared to other spacing. The results were also similar to

those of Shinde *et al.*, (2005) and Hasanuzzaman *et al.*, (2009) for panicle length. Bhowmik *et al.*, (2012) reported maximum number of grains per panicle from widely spaced plants as compared to closely spaced plants (Table 2).

Among different dates of transplanting highest panicle length (26.6 cm) was attained on July 12 (D₁) than July 27 (D₂) and August 11 (D₃). Similarly, number of grains/panicle (109.1) and test weight (27.9g) was highest on July 12 transplanting date and lowest was

obtained on August 11 transplanting date. The present results were in conformity with Paliwal *et al.*, (1996) who reported that there was significant reduction in panicle length due to delayed transplanting. Bali *et al.*, (1995) also reported that number of grains was adversely affected by delayed transplanting. The present results were in agreement with Chopra *et al.*, (2003) and Sharma *et al.*, (2011) who reported significantly higher grain weight in early transplanting over late transplanting.

Table.1 Effect of plant spacings and transplanting dates on the plant height and number of tillers/plant of rice

Treatment	Plant height (cm)	No. of tillers/plant
Plant spacing		
S ₁ (25×15cm)	99.1	16.8
S ₂ (20×15cm)	102.9	15.7
S ₃ (15×15cm)	105.9	15.6
LSD (P=0.05)	1.2	0.6
Transplanting dates		
D ₁ (July 12)	113.0	19.6
D ₂ (July 27)	104.9	16.4
D ₃ (August 11)	90.1	12.2
LSD (P=0.05)	1.7	0.8

Table.2 Effect of plant spacings and transplanting dates on the yield attributes of basmati rice

Treatment	Panicle length (cm)	No. of grains/panicle	1000-grain weight (g)
Plant spacing			
S ₁ (25×15cm)	25.3	101.6	28.5
S ₂ (20×15cm)	24.6	99.4	27.0
S ₃ (15×15cm)	23.7	96.6	25.5
LSD (P=0.05)	0.5	2.3	0.8
Transplanting dates			
D ₁ (July 12)	26.6	109.1	27.9
D ₂ (July 27)	23.7	99.7	26.9
D ₃ (August 11)	23.3	88.8	26.1
LSD (P=0.05)	0.5	3.5	0.6

Table.3 Effect of plant spacing and transplanting date on grain yield, straw yield and harvest index of basmati rice

Treatment	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)
Plant spacing			
S ₁ (25×15cm)	39.9	114.2	25.6
S ₂ (20×15cm)	46.8	126.7	26.6
S ₃ (15×15cm)	40.3	135.8	22.9
LSD (P=0.05)	1.9	9.6	1.3
Transplanting dates			
D ₁ (July 12)	56.3	165.9	26.1
D ₂ (July 27)	40.6	147.1	22.5
D ₃ (August 11)	30.2	129.7	19.9
LSD (P=0.05)	3.9	4.9	1.8

Yield

The different transplanting dates significantly influenced the grain yield and straw yield (Table 3). Transplanting basmati rice on July 12 (D₁) recorded significantly higher grain yield (56.3 q/ha) over July 27 (D₂) and August 11 (D₃). Similarly, highest straw yield was obtained on July 12 (165.9 q/ha) and lowest was obtained on August 11 (129.7 q/ha). The present results were in agreement with Panday and Agarwal (1991) and Mukesh *et al.*, (2013) who reported early transplanting recorded highest grain and straw yields and drastic reduction in yield was also reported by delayed transplanting.

Amongst the plant spacing, S₂ (20×15cm) treatment recorded highest grain yield (46.8 q/ha) as compare to S₁ (25×15cm) and S₃ (15×15cm) treatment. Similar results were also reported by Bhowmik *et al.*, (2012) and Moro *et al.*, (2016). Whereas, S₃ (15×15cm) treatment recorded highest straw yield (135.8 q/ha) which was highest than S₁ (25×15cm) and S₂ (20×15cm). The results for spacing were also similar to those of Kewat *et al.*, (2002) who also reported significantly highest straw yield at closer spacing than wider spacing. Similarly, harvest index (26.6%) was maximum in spacing S₂ (20×15cm) as

compare to others. The present results were in agreement with Chaudhury (1991) and Samdhia (1996) also reported maximum harvest index with spacing of 20cm × 15cm.

In conclusion, at varied transplanting dates and spacing, superior performance of basmati rice can be obtained with early transplanting and wider spacing. Transplanting of rice on July 12 and spacing of 20cm × 15cm gave higher grain yield.

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