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Response of Rice to Different Sowing Methods

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Abstract: Three sowing methods (normal transplanting, direct seeding in lines and in broadcast fashion) were tested to study the response of two Basmati rice cultivars for paddy yield and growth. Pre-soaked rice seed was drilled in lines of 25 cm apart or broadcasted in field under 'water' (optimal soil moisture) condition. Data were collected on plant height, panicles m^{-2} , grains panicle $^{-1}$, sterility percentage, 1000-grain weight, paddy yield and straw yield. Statistical analysis displayed that Super Basmati outclassed Basmati-370 by producing greater paddy yield with more grains panicle $^{-1}$ and 1000-grain weight. It was further revealed that although transplanting method produced greater plant height, grains panicle $^{-1}$ and 1000-grain weight but produced statistically similar paddy yield as obtained with direct sowing. It was suggested that Basmati rice could be used for direct sowing under Faisalabad conditions. Rice could be drilled or broadcasted. However, direct sowing in lines is more effective due to easy intercultural operations like weeding, spraying, etc. and uniform plant stand.

Key words: Rice, transplanting, direct seeding, Basmati-370, Super Basmati

Introduction

Rice, the second most important staple food of Pakistan, is grown in all the provinces. Normally nursery is sown at the end of May and transplanting is done during the first week of July. This is a traditional method. High and stable yields are obtained but labor and water expenses are high. Further more, land preparation, specially puddling is necessary to develop a hard pan to minimize the water losses via deep percolation. Now-a-days farmers are switching to other methods of sowing rice to minimize these expenses and difficulties. Direct sowing of rice was reported to reduce the labor cost by 30 percent and overall production cost by 40 percent in Malaysia (IIMI Annual Report, 1994).

Farmers can choose among three different methods of planting rice i.e., transplanting, wet sowing and dry sowing. The latter two constitute direct sowing. Amount of irrigation water for each of these methods differs greatly but so also do crop yields, labor expenses and overall economic returns. In case of wet sowing method, fields are saturated, puddled, leveled and then drained. Pre-germinated seed is then broadcasted. In this method the growing period is about 10 days longer than is transplanting method, in which seedlings are first raised in the nursery for about 25 days. Therefore, water demand for wet sowing is greater than the other methods. However, it reduces labor cost and thus increases the profits.

Dry sowing is practiced under water shortage conditions. Seeds are plowed into the soil before the onset of the rains. Irrigation water is provided only when rainfall has stimulated germination and the seedlings have established. Because pre-saturation is avoided and the irrigation period is shortened, this method reduces the consumption of water. However, it also lowers the yields due to intrusion of weeds and uneven germination.

Various efforts have successfully been made in this respect. Tsai *et al.* (1986) indicated that number of tillers and panicles were greater in direct sown rice than in transplanted one. Similarly Majid *et al.* (1989) obtained highest yield, from plots drilled with single row seeds under dry conditions. Luzes (1991) obtained highest grain yield of a Japonica rice cv. Ringo, when it was drilled on dry seedbed leveled using the laser plane system. In another study Nagashima *et al.* (1990) observed that heading was 5-6 days later and maturity 6-10 days later with direct sowing than with transplanting.

This study was, therefore, planned to determine the effect of three sowing methods on the growth and yield of Basmati rice under Faisalabad conditions. Traditional method of transplanting is compared with direct sowing.

Materials and Methods

The study was conducted in the research area of the Water Management Research Centre, University of Agriculture, Faisalabad during the crop season 1999. Two Basmati rice cultivars Basmati-370 and Super Basmati were used to study the effect of different sowing methods on their yield. A Randomized Complete Block Design in split-plot fashion was used to conduct the experiment. Varieties were kept in main-plots while sowing methods were randomized in sub-plots. Plot size was kept $4.5 \times 15 m^2$. Rice was direct sown at a seed rate of $300 g plot^{-1}$ ($45 kg ha^{-1}$). In Faisalabad rainy season is not so reliable and continuous, therefore, a modified dry wet $^{-1}$

method is used in which pre-soaked seeds were drilled into the soil in lines of 25-cm apart or broadcasted in well prepared fields under 'water' condition (optimal soil moisture). After sowing the field was given light irrigation to aid the establishment of seedlings. Afterwards irrigation was given at proper intervals. Fertilizer was applied at recommended rates. Intercultural operations were carried out to eradicate the weeds. For the control of termites Heptachlor @ $1 L ha^{-1}$ was used, stem borer was controlled by Furadan.

Data on various plant and yield traits viz., plant height, number of panicles m^{-2} , grains panicle $^{-1}$, sterility percentage in panicles, 1000-grain weight, paddy yield and straw yield were recorded and subjected to analysis of variance according to Steel and Torrie (1984) to work out the significant differences among treatment means. Treatment means were compared using LSD test.

Results and Discussion

Statistically analyzed data are presented in Table 1 and 2. The two Basmati varieties differed significantly from each other for plant height, number of panicles m^{-2} grains panicle $^{-1}$, sterility percentage, 1000-grain weight, paddy yield and straw yield. Similarly sowing methods presented significant difference for plant height, number of panicles m^{-2} , and 1000-grain weight while other parameters differed non-significantly. The combined effect of varieties and sowing methods presented significant difference for 1000-grain weight and paddy yield only.

Varieties: Basmati - 370 is a tall variety thus, it attained greater height (153.0 cm) than Super (108.6 cm). However, its height was maximum (165.5 cm) when it was transplanted as compared to, when it was directly sown (Table 2). Number of panicles m^{-2} were maximum in Super with greater grains per panicle as compared to Basmati-370. Super produced maximum panicles m^{-2} i.e., 428.8 and 418.5 in broadcast and line sown fashion, respectively. However, it produced maximum grains per panicle when transplanted as compared to direct sown. However, these differences were non-significant.

Sterility percentage was greater in Basmati-370 than Super. It was maximum when rice was directly sown than when it was transplanted. Super outclassed Basmati-370 by producing greater paddy yield whether transplanted or directly sown. This was due to greater 1000-grain weight, grains panicle $^{-1}$ and number of panicles m^{-2} in Super aided by lesser sterility percentage. On the other hand Basmati-370 had lesser grains panicle $^{-1}$ and greater estimate of sterility in panicles which resulted in lesser yield and greater biomass. The results suggest that Super can safely be direct sown in lines to obtain good yield because it showed suitable growth and development under all sowing methods.

Sowing methods: A perusal of Table 2 indicated that plant height was significantly greater when rice was sown by transplanting as compared to when it was directly seeded. Direct sowing in lines or broadcast fashion did not produce any difference in plant height. However number of panicles m^{-2} were greater in directly sown rice as compared to transplanted rice. Tsai

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Table 1: Analysis of variance for various yield characters as affected by different sowing methods (Mean squares)

SOV	df	Plant height	Panicles m ⁻²	Grains panicle ⁻¹	Sterility	1000-grain weight	Paddy yield	Straw yield
Replications	2	312.04	3701.85	112.25	106.96	1.13	3.49	0.68
Varieties (V)	1	8875.12**	134248.35**	1424.89*	1477.32**	20.99**	21.33*	3.05*
Error(a)	2	87.31	522.76	52.24	13.16	0.09	0.34	0.05
Methods (M)	2	361.13**	4303.51	714.03	17.03	7.56*	0.09	0.02
V x M	2	59.01	850.10	36.80	12.33	9.15*	0.28*	0.34
Error(b)	8	22.94	737.45	33.24	9.69	1.33	0.05	0.20

* = P ≤ 0.05, ** = P ≤ 0.01

Table 2: Mean values of the characters studied showing statistical significance

Treatments	Plant height (cm)	Panicles m ⁻²	Grains panicle ⁻¹	Sterility (%)	1000-Grain weight(g)	Paddy yield(t ha ⁻¹)	Straw yield(t ha ⁻¹)
Varieties							
V ₁	153.0a	229.5b	89.6b	33.95a	17.5b	1.0b	10.2b
V ₂	108.6b	402.2a	107.4a	15.83b	19.7a	3.2a	9.3a
LSD	18.95	46.37	14.7	7.36	1.6	1.2	0.5
Methods							
M ₁	139.7a	286.3b	110.9a	23.00	19.9a	2.2	9.9
M ₂	127.7b	322.7a	94.3b	26.24	17.9b	2.0	9.7
M ₃	125.1b	338.6a	90.4b	25.44	18.1b	2.0	9.7
LSD	6.38	36.15	7.7	-	1.5	-	-
Interaction							
V ₁ M ₁	165.5	213.3	101.0	30.97	20.2	1.4	10.3
V ₁ M ₂	148.0	226.8	83.5	36.92	15.9	0.9	9.9
V ₁ M ₃	145.7	248.3	84.3	33.97	16.5	0.8	10.3
V ₂ M ₁	113.8	359.3	120.8	15.04	19.6	3.1	9.3
V ₂ M ₂	107.4	418.5	105.0	15.56	19.9	3.2	9.6
V ₂ M ₃	104.6	428.8	96.5	16.90	19.6	3.2	9.1
LSD	-	-	-	-	2.17	0.4	-

Means sharing common letters do not differ significantly using LSD at 0.05 probability level. V₁ = Basmati-370, V₂ = Super Basmati M₁ = Normal transplanting, M₂ = Direct seeding in lines and M₃ = Direct broadcast

et al. (1986) have also reported greater number of panicles in direct sown rice as compared to transplanted rice. However, number of grains panicle⁻¹ and 1000-grain weight were greater when rice was sown by transplanting. These results indicated that the transplanted rice presented more plant height, grains panicle⁻¹ and 1000-grain weight and lesser sterility percentage in panicles, which enabled transplanting method as beneficial. On the other hand more number of panicles m⁻² under direct sown conditions were obtained which resulted due to close spacing between plants. This developed competition for nutrients and finally resulted in slight reductions in other plant traits. However, the final economic production was non-significant when compared with transplanted rice. On the contrary Luzes (1989) and Majid *et al.* (1989) obtained high yield of rice when sown directly in lines. This discrepancy may be due to difference in the experimental material and the environmental conditions under which the experiments were conducted. The non-significant differences in our study signify the equal usefulness of both sowing methods i.e., transplanting and direct sowing. However, reduced labor charges in direct sowing made it more useful.

Basmati rice could be used for direct sowing under Faisalabad conditions. Although transplanting produces high yields but yield losses by direct sowing are not significant and could be compensated by eliminated labor charges. Rice could be drilled or broadcasted. However, direct sown in line is more effective due to easy intercultural operations like weeding, etc. and uniform plant stand.

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