

Effect of sowing method and seed rate on the performance of high-yielding varieties of rice (*Oryza sativa*)

R. B. THAKUR

Department of Agronomy, Rajendra Agricultural University, Pusa, Bihar 848 125

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ABSTRACT

An experiment was conducted during the rainy (*khari*) seasons of 1989 and 1990 to study the effect of 2 methods of sowing (direct seeding and transplanting) and 2 seed rates (normal and 25% more than normal) on performance of 3 varieties of rice (*Oryza sativa* L.) at Pusa. Transplanted rice proved better than direct-sown crop irrespective of seed rates. Similar trend was observed for production/day/ha also. Among the varieties, 'Radha' showed superiority to rest of the varieties ('Saket 4' and 'Sujata') tested. The production/day/ha was the highest in short-duration crop compared with long-duration crop. The duration of the crop was reduced by about 7 days in direct-sown crop compared with transplanted one. Transplanting gave higher monetary returns than direct seeding, while both the methods were almost similar in cost : benefit ratio.

Transplanted rice (*Oryza sativa* L.) is more productive and it is one of the surest methods for obtaining good yield of rice. Direct seeded-rice crop is more economical than a transplanted one, if managed satisfactorily. Seed rates have also importance in maintaining plant population. Now-a-days labour cost is increasing day by day and direct-seeded rice seems more suitable in multiple-cropping programme due to early maturation. Since no such type of information is available for high-yielding varieties of rice for north Bihar situation, the present investigation was undertaken.

MATERIALS AND METHODS

The field experiment was conducted during the rainy (*khari*) seasons of 1989 and 1990 at Pusa. The soil of the experimental field was silty loam with pH 8.5, having available N 276 kg/ha, available P_2O_5 37.4

kg/ha and available K_2O 132.7 kg/ha. The treatments consisting of 2 methods of planting (direct seeding of seeds and transplanting of seedlings) in main plots, 2 seed rates (normal and 25% more than the normal) in subplots and 3 varieties ('Saket 4', 115 days crop; 'Sujata', 135 days crop and 'Radha', 150 days crop) in sub-subplots were taken up in split split-plot design with 3 replications. Transplanting was done in puddled soil at a distance of 15 cm $\times$ 15 cm in early- and medium-duration crops. In case of long-duration crop it was kept 15 cm $\times$ 20 cm in normal condition and in case of 25% more than normal plant-to-plant distance was 12 cm in place of 15 cm in all the maturation groups. In direct-sown condition, 80 kg and 100 kg seed rates were used and sown behind the plough at a distance of 20 cm apart.

Rice was sown in nursery-bed or main

Table 1. Yield and yield attributes of rice varieties as influenced by method of planting and seed rate

Treatment	Days to maturity		Panicles/m ²		Fertile grains/panicle		1,000-grain weight (g)		Grain yield (q/ha)		Grain yield (kg/day/ha)	
	1989	1990	1989	1990	1989	1990	1989	1990	1989	1990	1989	1990
<i>Method of planting</i>												
Direct seeding	130.2	129.9	304.7	306.8	80.2	78.8	20.9	21.0	23.1	37.6	17.8	28.9
Transplanting	137.8	137.3	298.3	301.9	82.9	85.7	21.2	21.6	24.7	40.7	17.9	29.7
CD (P = 0.05)	4.8	5.7	NS	NS	NS	5.3	NS	0.4	NS	1.9	NS	0.5
<i>Seed rate</i>												
Normal	133.1	137.7	297.8	306.7	81.3	82.7	21.0	21.3	23.3	38.8	17.5	29.1
25% more than normal	135.3	134.2	302.6	312.8	81.0	82.1	21.1	21.3	24.5	39.5	18.1	29.4
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.6	NS
<i>Variety</i>												
'Saket 4'	114.3	114.9	292.2	297.8	74.2	76.2	20.1	20.3	19.4	34.4	17.0	29.9
'Sujata'	135.7	134.6	303.7	312.2	83.1	84.7	21.6	21.8	24.8	40.4	18.2	29.9
'Radha'	151.6	151.2	308.7	319.1	84.8	86.2	21.6	21.9	27.4	42.7	18.0	28.3
CD (P = 0.05)	3.5	4.0	8.0	7.1	5.1	4.2	0.3	0.3	1.5	1.2	0.3	0.3

NS, Not significant

field where needed in the first week of June and transplanting was done by 30-day old-seedlings in required plots.

A common dose of N, P₂O₅ and K₂O @ 80, 40 and 20 kg/ha was used in all the treatments as urea, single superphosphate and muriate of potash respectively. Nitrogen was applied in 3 splits, i.e. 25% basal, 50% at tillering and 25% at panicle-initiation stages. Grain yield (at 14% moisture level) and other ancillary characters were recorded at the time of harvest. The economics was worked by considering the current market prices. In the first year early withdrawal of rain in September led to reduced effective tillers causing substantial yield reduction.

RESULTS AND DISCUSSION.

Method of seeding

The highest grain yield of 24.7 and 40.7 q/ha in 1989 and 1990 was recorded in transplanting compared with direct seeding

irrespective of seed rates. However, in the first year the direct-seeding and transplanting did not differ significantly. This probably happened due to higher number of fertile grains/panicle and 1,000-grain weight in transplanted rice compared with direct-seeded one. The panicles/m² were more or less same in both the methods. It indicates that method of sowing did not affect the grain yield. Days to maturity also decreased by about 7 days in direct-sown crop compared with transplanted crop. The per day reduction was higher under transplanting than that under direct-seeding.

Seed rate

In most of the characters studied, both the seed rates were statistically alike, however, it gave higher values in all the cases (Table 1). For grain yield there was an increase of 5.2 and 2.0% in 25% higher seed rate over normal rate in 1989 and 1990 respectively.

Table 2. Monetary returns in rice as influenced by method of planting and seed rate

Treatment	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)		Net returns (Rs/ha)		Cost : benefit ratio	
		1989	1990	1989	1990	1989	1990
<i>Method of planting</i>							
Direct seeding	3,545	5,427	8,836	1,882	5,291	0.53	1.49
Transplanting	3,890	5,804	9,564	1,914	5,674	0.49	1.46
CD (P = 0.05)		295	384	NS	221		
<i>Seed rate</i>							
Normal	3,687	5,475	9,118	1,788	5,431	0.48	1.47
25% more than normal	3,747	5,757	9,282	2,010	5,535	0.54	1.48
CD (P = 0.05)		271	NS	NS	NS		
<i>Variety</i>							
'Saket 4'	3,717	4,559	8,084	842	4,367	0.23	1.17
'Sujata'	3,717	5,858	9,494	2,141	5,777	0.58	1.55
'Radha'	3,717	6,439	10,034	2,722	6,317	0.73	1.70
CD (P = 0.05)		262	287	235	209		

In both the years cost of cultivation was same

NS, Not significant

Variety

Among the varieties, 'Radha' recorded higher grain yield of 27.4 q/ha (1989) and 42.7 q/ha (1990) and showed superiority to rest of the varieties. 'Sujata' was the next best. This might be due to higher number of panicles/m², fertile grains/panicle and higher 1,000-grain weight in 'Radha' rice. 'Saket 4' recorded lowest maturation period (115 days) and hence maximum per day production was observed in this variety. This was followed by 'Sujata' (135 days) and 'Radha' (150 days).

Interaction effect

Interaction was not significant between methods of planting, seed rates and varieties.

However, in drought years direct seeding performed better in combination with short-duration variety. This might be due to early maturation in direct seeding in comparison to transplanting.

Economics

Transplanting gave the highest gross return and net return in both the years of experimentation and showed superiority to direct seeding. However, cost : benefit ratio was almost alike under direct seeding and transplanting. For the seed rates, both the rates were statistically similar in respect of returns as well as cost : benefit ratio. Rice 'Radha' recorded higher economic returns and 'Sujata' was the next best variety.