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Effect of planting time and nitrogen on production potential of basmati rice (*Oryza sativa*) cultivars in Bihar plateau

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ABSTRACT

A field experiment was conducted during rainy season of 1996-97 on clay-loam soil at Ranchi to study the effect of transplanting time (7 and 22 July) and nitrogen levels (60, 80 and 100 kg/ha) on production potential and profitability of scented rice (*Oryza sativa* L.) cultivars ('Sugandha', 'Basmati 370', 'Pusa Basmati 1' and 'BR 10'). A split-plot design was followed keeping transplanting time in main plot and combinations of varieties and nitrogen levels in subplot, with 3 replications. Timely transplanted (7 July) crop gave 17.2, 18.7, 18.8 and 14.4% higher grain yield, net return, net benefit : cost ratio and monetary productivity than late-planted crop (2,225 kg/ha, Rs 18,319/ha net return, 3.41 net benefit : cost ratio and Rs 136.7/ha/day monetary productivity). Rice variety 'Pusa Basmati 1' gave significantly higher grain yield (2,930 kg/ha) with physical productivity (21.7 kg/ha/day), net return (Rs 24,372/ha), net benefit : cost ratio (4.54) and monetary productivity (Rs 180.53/ha/day) than the remaining. Each incremental level of nitrogen gave significantly higher grain yield over its preceding level; and maximum grain yield (2,647 kg/ha), physical productivity (19.94 kg/ha/day), net return (Rs 24,372/ha), net benefit : cost ratio (4.54) and monetary productivity (Rs 180.53/ha/day), net return (Rs 22,536/ha) net benefit : cost ratio (4.07) and monetary productivity (Rs 162.13/ha/day) were obtained at 100 kg N/ha. Rice 'Pusa Basmati 1' and 'Sugandha' responded up to 100 kg N/ha, whereas 'Basmati 370' and 'BR 10' responded only up to 80 and 60 kg/ha respectively.

Key words : Basmati rice, Planting time, Nitrogen

Rice (*Oryza sativa* L.), occupying more than 90% area, is a dominant rainy season cereal in eastern India. In Bihar about 25% of rice area (5.4 million ha) is under medium land situation, which suits well for the cultivation of fine rice. Therefore it is necessary to increase the area and productivity of scented rice to earn foreign exchange for sustainable economic growth of the country. However, its cultivation is not as popular as of coarse rice. Consequently information related to suitability of its genotypes, planting time and nitrogen need in plateau region of

Table 1. Effect of transplanting time and nitrogen on yield attributes, yield and economics of basmati rice cultivars (mean of 2 years)

Treatment	Panicles /m²	Pancile length (cm)	Grains/ panicle	1000-grain weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index	Physical productivity (kg/ha/day)	Net return: (Rs/ha)	Benefit cost ratio	Monetary productivity (Rs/ha/day)
Transplanting time											
7 July	321	23.8	72	22.9	2,607	4,024	39.31	18.76	21,748	4.05	156.46
22 July	305	24.3	64	22.3	2,225	3,675	37.84	16.60	18,319	3.41	136.71
CD (P = 0.05)	14	0.4	6	0.5	210	335	NS	1.42	1,892	0.51	16.24
Genotype											
Sugandha	308	24.1	64	23.4	2,272	4,040	36.01	16.23	19,135	3.56	136.68
Basmati 370'	310	24.2	60	23.9	2,267	3,664	38.18	17.44	18,028	3.35	138.68
Pusa Basmati-1'	332	24.8	86	20.6	2,930	3,361	46.56	21.70	24,372	4.54	180.53
BR 10	301	23.1	64	22.5	2,189	4,335	33.54	15.64	18,599	3.46	132.85
CD (P = 0.05)	11	0.4	5	0.5	205	328	3.27	1.30	1,843	0.42	15.53
Nitrogen (kg/ha)											
60	304	23.7	64	22.2	2,202	3,456	38.94	16.43	17,512	3.38	130.69
80	314	24.1	68	22.6	2,403	3,818	38.59	17.54	20,054	3.74	146.38
100	322	24.3	72	23.1	2,647	4,275	38.20	19.04	22,536	4.07	162.13
CD (P = 0.05)	7	0.3	3	0.3	175	280	NS	1.03	1,577	0.32	14.32

Table 2. Grain yield (kg/ha) of basmati rice cultivars as affected by nitrogen (mean of 2 years)

Genotype	Nitrogen (kg/ha)		
	60	80	100
'Sugandha'	2,023	2,217	2,588
'Basmati 370'	2,053	2,286	2,467
'Pusa Basmati 1'	2,681	2,940	3,180
'BR 10'	2,051	2,168	2,351
CD (P = 0.05)		227	

Bihar is lacking. Hence this experiment was undertaken.

MATERIALS AND METHODS

A field experiment was conducted during rainy season of 1996 and 1997 at the university farm, Ranchi on clay-loam soil, slightly acidic in reaction (pH 6.5), low in available N (198 kg/ha), and medium in available P_2O_5 (35.6 kg/ha) and K_2O (178.4 kg/ha). The experiment was laid out in split-plot design, keeping 2 transplanting times (7 and 22 July) in main plot and combinations of 4 genotypes 'Sugandha', 'Basmati 370', 'Pusa Basmati 1' and BR 10 and 3 nitrogen levels 60, 80 and 100 kg/ha in subplot with 3 replications. A uniform dose of 40 kg phosphate and 20 kg potash/ha along with half dose of nitrogen (as per treatment) was applied basal. The remaining half nitrogen was top-dressed in 2 equal splits at tillering and panicle-initiation stages. Seedlings of 25 days were transplanted at a spacing of 20 × 15 cm using 2 seedlings/hill. The crop received 196.3 and 187.6 cm rain during the first and second years of experimentation respectively. Yield attributes, yield, physical productivity and economics were analysed to assess the effect of transplanting time and nitrogen level on scented rice genotypes.

RESULTS AND DISCUSSION

Effect of planting time

Timely transplanted (7 July) crop produced 17.2, 18.7, 18.8 and 14.4% higher grain yield, net return, net benefit : cost ratio and monetary productivity (Table 1) than late-planted crop 2,225 kg grain/ha, Rs 18,319/ha net return, 3.41 net benefit: cost ratio and Rs 136.71/ha/day monetary productivity) owing to better expression of yield components of timely planted crop. This confirms the findings of Singh *et al.* (1993) and Dhiman *et al.* (1997).

Effect of genotypes

'Pusa Basmati 1', a dwarf genotype, gave significantly higher grain yield (2,930 kg/ha) with physical productivity of 21.7 kg/ha/day, net return Rs 24,372/ha, net benefit : cost ratio 4.54 and monetary productivity Rs 180.55/ha/day due to more panicles per unit area (327/m^2), panicle length (24.8 cm) and grains/panicle (86) than the remaining genotypes 'Sugandha', 'Basmati 370' and 'BR 10'. 'Pusa Basmati

1' had 8.4, 12.0 and 13.8% lower test weight than 'BR 10', 'Sugandha' and 'Basmati 370' respectively, indicating the fineness of individual grain, a desired component of export quality. This confirms the findings of Singh *et al.* (1997).

Effect of nitrogen

Each incremental dose of nitrogen gave significantly higher grain and straw yield, net return, benefit: cost ratio as well as physical and monetary productivity over its the preceding dose. Consequently the crop fertilized with 100 kg N/ha gave maximum grain yield (2,647 kg/ha), physiological productivity (19.04 kg/ha/day), net return (Rs 22,536/ha), net benefit : cost ratio (4.07) and monetary productivity (Rs 162.13/ha/day). This confirms the findings of Dwivedi (1997).

Effect of genotype and nitrogen

'Pusa Basmati 1' and 'Sugandha' responded well to 100 kg N/ha with grain yield of 3,180 and 2,588 kg/ha respectively (Table 2). However, 'Basmati 370' and 'BR 10' responded only up to 80 and 60 kg N/ha with grain yield of 2,286 and 2,168 kg/ha respectively owing to higher yield attributes. It confirms the results of Singh *et al.* (1997).

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