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Influence of planting pattern on the yield and yield attributes of boro rice varieties

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Abstract

A split-plot designed experiment having three replications was conducted under the Department of Agronomy, Bangladesh Agricultural university, Mymensingh during boro season of 2000-2001 to evaluate the influence of planting pattern on the yield and yield attributes of boro rice varieties. Two modern varieties of boro rice [BINA dhan6 and BRRI dhan29] were transplanted in twelve planting patterns [four single rows viz. 25 cm × 20 cm, 25 cm ×17.5cm, 25 cm × 15cm, 25 cm × 12.5cm and eight paired rows viz. (25 cm + 15cm) × 20 cm, (25 cm + 15 cm) × 17.5cm, (25 cm + 15 cm) × 15cm, (25 cm + 15 cm) × 12.5cm, (35 cm + 15cm) × 20 cm, (35 cm + 15 cm) × 17.5cm, (35 cm + 15 cm) × 15cm, (35 cm + 15 cm) × 12.5cm]. It was found that, varieties were identical in respect of yield and most of the yield components. Planting pattern significantly influenced the yield and yield attributes. Generally, paired row planting and closer spacing produced higher yield. The highest grain yield (7.16 t ha^{-1}) was obtained from (35cm + 15cm) × 12.5cm pattern, which was comparable to those of (35cm + 15cm) × 15cm and 25cm × 12.5cm patterns. Grain yield was the lowest (6.20 t ha^{-1}) in 25cm × 20cm pattern. Yield and yield components did not vary significantly due to the interaction of variety and planting pattern.

Keywords: Planting pattern, Rice varieties, Grain yield

Introduction

Rice, the principal crop of Bangladesh, grows throughout the year in three seasons. Although the level of rice production has been increased from 9.93 million tons in 1972-73 to 25.08 million tons in 2000-2001, yet its growth rate (1.1) fails to keep pace with the population growth rate (1.48) (BBS, 2001). The country will have to produce 36.8 million tons of food grain in the year 2025-26 (Rashid, 1994) to feed her ever increasing population, which is very hard to achieve. The national average yield of rice is very low (2.32 t ha^{-1}), although, there are a number of modern varieties of rice having high yield potentiality (7.5 t ha^{-1} in BRRI dhan29, 8.0 t ha^{-1} in BINA dhan6). There exists a large gap between the national average yield and the potential yield. Hence, there remains a scope to increase the production of rice by minimizing the gap through adoption of appropriate variety and proper agronomic management practices. Planting pattern is an important agronomic management factor that determines the yield and quality of rice. Proper row and hill arrangements may help better nutrient uptake and receive maximum insolation thereby increasing photosynthesis and yield of rice. In Bangladesh, modern rice varieties are generally transplanted in single rows with 25cm × 15cm spacing. It is generally agreed that higher yields are obtained from closer spacing. Rajarathinam and Balasubramaniyan (1999) reported that yield parameter in rice were more with higher plant population (50 hills m^{-2}) while, Budhar *et al.* (1993) reported that grain yield of rice was not affected by spacing. Besides the single row, rice can be transplanted in paired row arrangements. Singh *et al.* (1986) observed that among single, double and triple row arrangements, the maximum LAI, CGR from flowering to maturity, maximum number of panicles m^{-2} and the highest grain yield were in three row sets of 10/30 cm pattern and the lowest yield was in three row sets of 20/50cm pattern. On the contrary, similar grain yields (3.3, 3.1, 3.6 t ha^{-1}) from single, double and triple row planting patterns were reported by BRRI (1981). Hossain *et al.* (1990) showed that alternate row spacing of 35+15cm gave higher yield of rice. So, it seems that there exist difference of opinions about the effect of planting pattern on the productivity of rice and further research is needed in this line. For this reason, the present study is an attempt to investigate the influence of planting pattern on the yield and yield attributes of two modern varieties of boro rice.

Materials and Methods

An experiment was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh (Old Brahmaputra Floodplain Soil, AEZ-9) during the period from November 2000 to June 2001 to study the influence of planting pattern on the yield and yield attributes of boro rice varieties. Two modern varieties of boro rice [BINA dhan6 and BRRI dhan29] were transplanted in twelve planting patterns [single row – 25 cm × 20 cm, single row – 25 cm ×17.5 cm, single row – 25 cm × 15 cm, single row – 25 cm × 12.5 cm, paired row - (25 cm + 15 cm) × 20 cm, paired row - (25 cm + 15 cm) × 17.5 cm, paired row - (25 cm + 15 cm) × 15 cm, paired row - (25 cm + 15 cm) × 12.5 cm, paired row - (35 cm + 15 cm) × 20 cm, paired row - (35 cm + 15 cm) × 17.5 cm, paired row - (35 cm + 15 cm) × 15 cm and paired row - (35 cm + 15 cm) × 12.5 cm]. The experiment was laid out in split- plot design with three replications assigning variety in the main plots and planting pattern in the sub plots. The unit plot size was 4.0m × 2.0m. Fertilizer doses were 215, 180, 100, 117 and 04kg ha^{-1} of urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate respectively. Intercultural operations were given as and when necessary. Ten sample plants were collected randomly from each plot for determination of yield attributes. The rest plants of the plots were harvested separately for determination of yield and grain and straw from the ten sample plants were added to it to determine the grain and straw yield $plot^{-1}$. All the data were analyzed statistically and the means were compared by DMRT.

Results and Discussion

Panicle number m^{-2} and 1000-grain weight were significant but grain yield and other yield components remain unaffected due to variety (Table 1). Panicle number m^{-2} was higher in BRRI dhan29 while 1000-grain weight was higher in BINA dhan6 which attributed to the identical grain yield in these two varieties.

Table 1. Effect of variety on yield and yield attributes of boro rice

Variety	Panicle no.m^{-2}	Panicle length (cm)	Grains $panicle^{-1}$	1000 grain wt. (g)	Grain yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index
V1	217.81 b	22.67	108.22	24.32 a	6.67	13.57	0.49
V2	248.36 a	22.87	104.30	21.35 b	6.82	13.82	0.49
Level of significance	0.05	ns	ns	0.01	ns	ns	ns
CV (%)	10.54	3.05	7.79	3.05	2.65	2.77	1.85

In a column, figures bearing letter(s) in common do not differ significantly. ns = Not significant.
V1 = BINA dhan6, V2 = BRRI dhan29

Planting pattern significantly influenced panicle number m^{-2}, grain number $panicle^{-1}$, 1000- grain weight, grain yield and biological yield but panicle length and harvest index remained unaffected. Grain yield was the highest (7.16 t ha^{-1}) in (35cm + 15cm) × 12.5cm pattern which was at par with those of (35cm + 15cm) × 15cm and 25cm × 12.5cm patterns (Table 2). Higher grain yields were attributed to the higher yield components of these planting patterns. Lowest yield (6.20 t ha^{-1}) in 25cm × 20cm pattern was due to its lower yield components. Generally, higher grain yields were found in paired row plantings and in closer spacings. Higher utilization of light, air, water, nutrients by plants in paired row plantings and higher number of plant population in closer spacing might be the principal factors for higher yields. Higher yield in paired row planting was observed by Singh *et al.* (1986) and Hossain *et al.* (1990), on the other hand, higher yield in closer spacing was reported by Paraye *et al.* (1996).

Table 2. Effect of planting pattern on yield and yield attributes of boro rice

Planting pattern	Panicle no.m^{-2}	Panicle length (cm)	Grains panicle^{-1}	1000 grain wt. (g)	Grain yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index
P1	208.70 c	23.42	113.90 ab	23.74 cd	6.20 g	12.73 f	0.49
P2	220.00 a-c	22.49	101.40 cd	23.58 d	6.53 ef	13.29 de	0.49
P3	229.80 a-c	22.66	104.90 bc	24.74 ab	6.81 cd	13.80 bc	0.49
P4	250.70 a	22.50	112.70 ab	24.50 a-c	6.95 a-c	14.17 ab	0.49
P5	243.70 ab	22.45	101.10 cd	23.33 d	6.45 f	13.14 d-f	0.49
P6	244.70 ab	22.84	99.92 cd	24.85 ab	6.84 cd	13.86 bc	0.50
P7	251.70 a	22.73	104.80 bc	24.98 a	6.88 cd	13.91 bc	0.50
P8	208.50 c	23.00	114.10 ab	24.22 a-d	6.91 bc	14.09 ab	0.49
P9	242.00 a-c	22.73	105.20 bc	23.93 b-d	6.41 f	12.97 ef	0.50
P10	214.80 bc	22.08	92.70 d	24.71 ab	6.68 de	13.51 cd	0.49
P11	254.20 a	22.95	106.90 a-c	25.05 a	7.13 ab	14.26 ab	0.50
P12	228.30 a-c	23.35	117.40 a	24.18 a-d	7.16 a	14.56 a	0.49
Level of significance	0.05	ns	0.01	0.01	0.01	0.01	ns
CV (%)	10.54	3.05	7.79	3.05	2.65	2.77	1.85

In a column, figures bearing letter(s) in common do not differ significantly. ns = Not significant.
P1= 25cm × 20cm, P2= 25cm × 17.5cm, P3= 25cm × 15cm, P4= 25cm × 12.5cm, P5= (25cm +15cm) × 20cm, P6=(25cm +15cm) × 17.5cm, P7=(25cm +15cm) × 15cm, P8=(25cm +15cm) × 12.5cm, P9=(35cm + 15cm) × 20cm, P10=(35cm + 15cm) × 17.5cm, P11=(35cm + 15cm) × 15cm, P12=(35cm + 15cm) × 12.5cm.

Table 3. Effect of interaction of variety and planting pattern on yield and yield attributes of boro rice

Planting pattern	Panicle no.m^{-2}	Panicle length (cm)	Grains panicle^{-1}	1000 grain wt. (g)	Grain yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index
V1P1	9.53	23.00	115.79	23.74	6.23	12.96	0.480 b
V1P2	9.40	22.19	107.16	23.58	6.45	13.43	0.480 b
V1P3	7.60	22.58	110.11	24.74	6.62	13.58	0.487 ab
V1P4	7.93	22.52	109.44	24.50	6.75	13.83	0.490 ab
V1P5	9.93	22.30	94.01	23.33	6.59	13.19	0.500 ab
V1P6	8.73	22.74	100.96	24.85	6.69	13.36	0.500 ab
V1P7	7.33	22.37	108.02	24.98	6.73	13.67	0.493 ab
V1P8	5.73	23.26	119.84	24.22	6.75	13.81	0.487 ab
V1P9	11.80	22.50	106.89	23.93	6.42	13.06	0.493 ab
V1P10	8.07	23.75	113.75	24.71	6.55	13.45	0.487 ab
V1P11	7.80	22.74	111.20	25.05	7.09	14.08	0.503 a
V1P12	7.00	22.11	101.49	24.18	7.12	14.36	0.497 ab
V2P1	11.33	23.83	112.28	21.12	6.17	12.50	0.497 ab
V2P2	9.73	22.78	95.57	21.17	6.61	13.15	0.500 ab
V2P3	10.07	22.75	115.34	21.47	6.99	14.02	0.497 b
V2P4	8.24	22.49	100.36	20.81	7.14	14.51	0.493 ab
V2P5	10.37	22.60	108.10	21.13	6.30	13.08	0.480 b
V2P6	9.00	22.93	98.88	22.39	6.99	14.37	0.490 ab
V2P7	8.80	23.08	101.54	21.65	7.04	14.16	0.497 ab
V2P8	7.93	22.74	108.41	21.27	7.07	14.37	0.493 ab
V2P9	12.40	23.02	103.44	20.97	6.41	12.88	0.497 ab
V2P10	10.60	22.96	121.12	22.03	6.80	13.58	0.500 ab
V2P11	8.23	23.17	102.61	21.50	7.17	14.43	0.497 ab
V2P12	7.73	22.04	83.91	20.66	7.19	14.76	0.490 ab
Level of significance	ns	ns	ns	ns	ns	ns	0.05
CV (%)	10.54	3.05	7.79	3.05	2.65	2.77	1.85

In a column, figures bearing letter(s) in common do not differ significantly. ns = Not significant.
V1 = BINA dhan6, V2 = BRRI dhan29. P1= 25cm × 20cm, P2=25cm × 17.5cm, P3= 25cm × 15cm, P4=25cm × 12.5cm, P5=(25cm +15cm) × 20cm, P6=(25cm +15cm) × 17.5cm, P7=(25cm +15cm) × 15cm, P8=(25cm +15cm) × 12.5cm, P9=(35cm + 15cm) × 20cm, P10=(35cm + 15cm) × 17.5cm, P11=(35cm + 15cm) × 15cm, P12=(35cm + 15cm) × 12.5cm.

Yield and yield components did not vary significantly due to the interaction of variety and planting pattern. Harvest index was the highest (0.503) in BINA dhan6 with (35cm + 15cm) × 17.5cm pattern, which was at par with a number of treatment combinations. The lowest harvest index (0.480) was in BINA dhan6 with 25cm × 20cm or with 25cm × 17.5cm pattern or in BRRI dhan29 with 25cm × 15cm pattern (Table 3).

From the above discussion, it is concluded that, BINA dhan6 and BRRI dhan29 were identical in respect of grain yield. Generally, paired row planting and closer spacing produced higher yield in rice.

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