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Performance of modern *boro* rice varieties under different planting methods

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Abstract

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during January-May 2006 to determine the effect of variety and planting method on the yield of *boro* rice. Four varieties viz., BINADHAN-5, BINADHAN-6, BRRI dhan28 and BRRI dhan29, and three planting methods viz., transplanting method, drum seeding and line sowing were included as experimental treatments. The experiment was laid out in a randomized complete block design with three replications. BINADHAN-5 produced the highest grain yield (4.61 t ha^{-1}) which was the consequence of highest number of effective tillers $hill^{-1}$ and highest number of grains $panicle^{-1}$. Among the planning methods, transplanting method produced the maximum grain yield (4.59 t ha^{-1}) because of highest number of grains $panicle^{-1}$. In case of effect of interaction of BINADHAN-5 and transplanting method produced the highest grain (5.20 t ha^{-1}) yield. It may be concluded that the variety BINADHAN-5 may be grown following transplanting method for higher grain yield in boro season.

Keywords: Variety, Planting method, Grain yield, *Boro* rice

Introduction

In Bangladesh, the expected yield of *boro* rice varies from 4.5-5.5 t ha^{-1} (BRRI, 1995). But in reality, this is not achieved, for which average rice yield of our country is low. It is, therefore, important to know the present yield levels of different HYV so that measures can be taken to increase the production of *boro* rice. Method of rice cultivation varies from region to region. There are three major methods of rice crop establishment namely, transplanting, wet-seeding and dry seeding (Pandey, 1994). Wet-seeding method is becoming increasingly popular because the transplanted high yielding rice cultivars require high inputs, specially water and labour. Direct wet-seeding in rice is an alternative to the practice of transplanting in puddled fields. Under this method pre-germinated rice seeds are sown in line or broadcast directly. It curtails the cost of nursery management, uprooting and transplanting of seedlings. Yield of wet-seeded rice may be as good as transplanted rice or even higher (Talukder, 1996). Direct wet-seeded crop can overcome many agronomic constraints because of earlier maturity than transplanted one (Eunus and Sadeque, 1975; BRRI, 1992). The availability of short duration, photosensitive, semi-dwarf and modern rice varieties has proved to be a boom for direct wet-seeded rice (Rahman, 1991). Wet sowing by drum seeder is gaining popularity day by day as it not only curtails the production cost but also reduces the growth duration of rice.

In the light of the above background, the present piece of research work was undertaken to find out the suitable variety and planting method for *boro* rice.

Materials and Methods

The research work was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from January to May 2006 (*boro* season) in order to determine the effect of variety and method of planting on the yield of *boro* rice. Geographically the experimental site is located at $24^0$75' N latitude and $90^0$50' E longitude at an elevation of 18 m above the mean sea level. The site belongs to the non-

calcareous dark gray floodplain soil under the Old Brahmaputra Floodplain Agro-ecological Zone (UNDP and FAO, 1988). The experimental field was a medium high land with silty clay loam soil having pH value of 7.3. The treatments included in the experiment were (i) four rice varieties, namely, BINADHAN-5, BINADHAN-6, BRRI dhan28, BRRI dhan29, and (ii) three methods of planting, namely, transplanting, drum seeding and line sowing. The experiment was laid out in a two factors randomized complete block design with three replications. The unit plot size was 4.0 m × 2.5 m.

The land was well prepared and fertilized with recommended rate of fertilizers i.e. urea (270 kg ha^{-1}), triple super phosphate (180 kg ha^{-1}), muriate of potash (120 kg ha^{-1}), gypsum (70 kg ha^{-1}) and zinc sulphate (10 kg ha^{-1}). Sprouted seeds were sown (by drum seeder or manually) for drum seeding and line sowing methods, in the main field on 1 December. And, in case of transplanting method, sowing date (in the seed bed) was the same i.e. 1 December, but transplanting was done on 10 January in the main field. Thus all the treatments got the same crop age. Intercultural operations, fertilization, weeding, water management and pest management were done as and when necessary. Harvesting was done when 90% of the grains become golden yellow in color. Five hills were randomly selected (excluding border hills) from each unit plot prior to harvest for recording data.

Data on plant height, number of total tillers $hill^{-1}$, number of effective tillers $hill^{-1}$, number of non effective tillers $hill^{-1}$, grains $panicle^{-1}$, sterile spikelets $panicle^{-1}$, 1000-grain weight, grain yield, straw yield, biological yield and harvest index were recorded and calculated at harvest. Total growth duration (TGD) was counted under different planting methods. The recorded and calculated data (except TGD) were analyzed statistically and mean difference were adjudged by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Effect of variety

Variety exerted significant effect on all the parameters except 1000-grain weight (Table 1). The variety BINADHAN-5 produced the tallest plant (97.76 cm) flowed by BINADHAN-6 (94.25 cm) and the shortest one (89.86 cm) was recorded in BRRI dhan29. The highest number of effective tillers $hill^{-1}$ (13.67) was produced by the variety BINADHAN-5 whereas the lowest one (6.44) was recorded in BRRI dhan28. The probable reason of differences in producing the number of effective tillers $hill^{-1}$ is the genetic makeup of the variety. This finding corroborates with that reported by Chowdhury *et al.* (1993) who also recorded variation in effective tillers $hill^{-1}$ among the varieties. The highest number of grains $panicle^{-1}$ (159.33) was produced by the variety BINADHAN-5 whereas the lowest one (134.89) was obtained from BRRI dhan28. Singh and Gangwar (1989) also reported variable numbers of grains $panicle^{-1}$ among the varieties. Varietal differences regarding the number of grains $panicle^{-1}$ might be due to differences in their genetic constituents. The highest grain yield (4.61 t ha^{-1}) was produced by the variety BINADHAN-5 whereas the lowest one (3.68 t ha^{-1}) was obtained from BRRI dhan28 (Table 1). The highest grain yield in BINADHAN-5 was mostly attributed by highest number of effective tillers $hill^{-1}$ and the highest number of grains $panicle^{-1}$ but the lowest number of non-effective tillers $hill^{-1}$ and sterile spikelets $panicle^{-1}$ of this variety. On the other hand, BRRI dhan29 had the lowest number of effective tillers $hill^{-1}$ and lowest number of grains $panicle^{-1}$ but the highest number of non-effective tillers $hill^{-1}$ and highest number of sterile spikelets $panicle^{-1}$ which contributed to the worst performance of this variety. The highest harvest index (45.35%) was recorded from BRRI dhan28 and the lowest one (41.18%) was obtained form BINADHAN-5. Highest grain and straw ration in BRRI dhan28 might be resulted in the highest harvest index.

Table 1. Effect of variety on the yield components and yield of *boro* rice

Variety	Plant height (cm)	Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} (no.)	Grains panicle^{-1} (no.)	Sterile spikelets panicle^{-1} (no.)	1000-grain weight (g)	Grain yield (t ha^{-1})	Harvest index (%)
BINADHAN-5	97.76a	13.67a	2.44b	159.33a	13.67d	21.26	4.61a	41.18b
BINADHAN-6	94.25b	11.89b	3.22b	148.44b	15.78c	21.48	3.72b	44.50a
BRRI dhan28	93.71b	6.44d	6.67a	134.89c	18.89b	21.46	3.68b	45.35a
BRRI dhan29	89.86c	9.11c	6.44a	135.33c	21.56a	21.53	3.80b	44.52a
$\overline{S}$ x	1.13	0.43	0.43	1.69	0.56	0.21	0.07	0.51
Lever of significance	**	**	**	**	**	NS	**	**

In a column, figures having common letter (s) do not differ significantly whereas figures with dissimilar letter (s) differ significantly as per DMRT
** = Significant at 1% level of probability
NS = Not significant

Effect of planting method

Planting method significantly influenced only plant height, grains panicle^{-1}, sterile spikelets panicle^{-1}, grain yield and harvest index (Table 2). Results show that line sowing method produced the tallest plants (96.39 cm) followed by transplanting method (93.07 cm) which was statistically similar to drum seeding method (92.23 cm). The highest number of grains panicle^{-1} (148.25) was obtained from transplanting method and the lowest one (141.00) was found in line sowing (Table 2). A significant variation in grain yield (t ha^{-1}) was observed due to the planting method. The highest grain yield (4.59 t ha^{-1}) was obtained from transplanting method and the lowest one (3.52 t ha^{-1}) was found in line sowing method. Highest number of grains panicle^{-1} and lowest number of sterile spikelets panicle^{-1} mostly contributed to the highest grain yield produced by transplanting method. This finding is not in agreement with that reported by Ganajaxi *et al.* (2000) who found that transplanting and drum seeding methods produced statistically similar yields. But recorded higher grain yield from drum seeding than from line sowing in the year 1997 but in 1998, they got the reverse findings. The highest harvest index (47.92%) was calculated from transplanting method and the lowest one (41.17%) from line sowing method.

Table 2. Effect of planting method on the yield components and yield of *boro* rice

Planting method	Plant height (cm)	Effective tillers hill-1 (no.)	Non-effective tillers hill-1 (no.)	Grains panicle-1 (no.)	Sterile spikelets panicle-1 (no.)	1000-grain weight (g)	Grain yield (t ha-1)	Harvest index (%)
Transplanting	93.07b	9.92	4.67	148.25a	15.50c	21.24	4.59a	47.92a
Drum seeding	92.23b	10.42	4.42	144.25ab	17.67b	21.43	3.74b	42.56b
Line sowing	96.39a	10.50	5.00	141.00b	19.25a	21.63	3.52c	41.17c
$\overline{S}$ x	0.98	0.37	0.38	1.46	0.48	0.19	0.06	0.44
Lever of significance	**	NS	NS	**	**	NS	**	**

In a column, figures having common letter (s) do not differ significantly whereas figures with dissimilar letter (s) differ significantly as per DMRT
** = Significant at 1% level of probability
NS = Not significant

Effect of interaction of variety and planting method

Interaction of variety and planting method significantly influenced all the parameters except 1000-grain weight (Table 3). The highest number (15.67) of effective tillers hill^{-1} was found in BINADHAN-5 planted in transplanting method and lowest one (5.33) was obtained from the interaction of BRRI dhan28 planted in transplanting method. The numbers of grains panicles^{-1} varied significantly due to the interaction of variety and method of planting. The highest number of grains panicle^{-1} (164.60) was found in the combination BINADHAN-5 and transplanting method and the lowest one (130.33) in BRRI dhan28 in line sowing. The variation due to the interaction of variety and method of planting was significant in respect of grain yield (t ha^{-1}). The highest grain yield (5.2 t ha^{-1}) was observed in the interaction between BINADHAN-5 and transplanting method and the lowest one (3.2 t ha^{-1}) was recorded in the combination of BRRI dhan28 and drum seeding method (Table 3). The highest harvest index (51.65%) was calculated from BRRI dhan28 planted in transplanting method and the lowest one (37.42%) from the interaction between BRRI dhan29 and line sowing method (Table 3).

Table 3. Effect of interaction of variety and planting method on the yield components and yield of *boro* rice

Interaction (Variety× planting method)	Plant height (cm)	Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} (no.)	Grains panicle^{-1} (no.)	Sterile spikelets panicle^{-1} (no.)	1000-grain weight (g)	Grain yield (t ha^{-1})	Harvest index (%)	Total growth duration (days)
V1T1	101.10a	15.67a	2.33ef	164.60a	12.00d	21.13	5.20a	41.59de	155
V1T2	95.77ab	13.00bc	3.00def	162.00a	13.67cd	21.38	4.43b	41.31de	125
V1T3	96.43ab	12.33bcd	2.00f	151.33bc	15.33c	21.28	4.20b	40.63e	125
V2T1	93.50bc	10.67cde	3.33cdef	157.00ab	13.33cd	21.38	4.19b	47.16b	155
V2T2	93.48bc	13.33b	2.33ef	145.67cd	15.33c	21.42	3.75c	42.38cde	125
V2T3	95.77ab	11.67bcd	4.00cdef	142.67cde	18.67b	21.65	3.22d	43.96cd	125
V3T1	91.87bc	5.33h	4.67bcde	138.67def	14.67cd	21.15	4.47b	51.65a	145
V3T2	92.50bc	6.33gh	7.00ab	135.67ef	20.67ab	21.38	3.20d	41.73de	120
V3T3	96.78ab	7.67fg	8.33a	130.33f	21.33ab	21.85	3.36d	42.66cde	120
V4T1	85.83d	8.00fg	8.33a	132.67f	22.00a	21.30	4.52b	51.30a	155
V4T2	87.17cd	9.00ef	5.33bcd	133.67ef	21.00ab	21.56	3.59cd	44.83bc	125
V4T3	96.58ab	10.33de	5.67bc	139.67def	21.67ab	21.73	3.30d	37.42f	125
$\overline{S}x$	1.69	0.74	0.75	2.92	0.97	0.37	0.12	0.88	-
Lever of significance	**	**	**	**	**	NS	**	**	-

In a column, figures having common letter (s) do not differ significantly whereas figures with dissimilar letter (s) differ significantly as per DMRT

** = Significant at 1% level of probability
NS = Not significant

V_1 = BINADHAN-5
V_2 = BINADHAN-6
V_3 = BRRI dhan28
V_4 = BRRI dhan29

T_1 = Transplanting
T_2 = Drum seeding
T_3 = Line sowing

Total growth duration (TGD)

From Table 3 it is evident that planting method greatly influenced total growth duration (TGD). Irrespective of variety transplanting method took 25 to 30 days more to mature than line sowing or drum seedling method. The TGD for BINADHAN-5 or BINADHAN-6 or BRRI dhan29 was 155 days for transplanting method, but the same for line sowing or drum seeding method was just 125 days. The TGD for BRRI dhan28 under transplanting and line sowing or drum seeding methods were 145 days and 120 days, respectively. Irrespective of planting method TGD for BRRI dhan28 was the lowest among the varieties studied.

Conclusion

It may, therefore, be concluded that transplanting method performed the best in terms of yield. On the other hand, drum seeding or line sowing method may be chosen considering the total growth duration to ease the accommodation of the next crop. Though economic analysis of this study was not performed during the time of experimentation, but without any economic analysis it is clear that as line sowing or drum seeding method does not require seed bed preparation followed by seedling uprooting and transplanting so, it would obviously cost less than transplanting method. Therefore, though transplanting method produced the highest yield but either line sowing or drum seeding method may be an good option for our resource poor farmers. Among the varieties, BINADHAN-5 was the best yield performer followed by BRRI dhan29. But BRRI dhan28 may be chosen considering its minimum TGD.

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