Production potential of brri dhan28 as affected by transplanting date and nitrogen nutrition

M.M.R. Khalid[1], M.P. Anwar[2], M.M. Kamal[3], M.S. Rahman[4] and M.S.U.

1. Postgraduate student, Dept. of Agronomy, Bangladesh Agricultural University, Mymensingh, 2. Assistant professor, Dept. of Agronomy, Bangladesh Agricultural University, Mymensingh., 3. Postgraduate student, Dept. of Agronomy, Bangladesh Agricultural University, Mymensingh, 4. Training coordinator, HEED Bangladesh, Gaibandha, 5. Professor, Dept. of Agronomy, Bangladesh Agricultural University, Mymensingh.

Abstract: BRRI dhan28, a *boro* rice variety was transplanted on five different dates viz, 10 January, 20 January, 30 January, 10 February and 20 February under four levels of nitrogen viz., 75, 100, 125, 150 kg ha^{-1} at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during *boro* season (December to May) of 2005-06 with a view to studying the influence of transplanting date and nitrogen level on its production potential. The experiment was laid out in a randomized complete block design with three replications. Date of transplanting and nitrogen level significantly influenced different plant parameters like, plant height, effective and non–effective tillers hill^{-1}, panicle length, grains and sterile spikelets panicle^{-1}, grain and straw yields and harvest index except 1000-grain weight. The values of most of the studied characters except sterile spikeletes panicle^{-1} were the highest in 10 January transplanting. The highest grain (4.33t ha^{-1}), straw (4.82 t ha^{-1}) and biological (9.15 t ha^{-1}) yields were recorded from 150 kg N ha^{-1}. The highest grain yield (5.10 t ha^{-1}) was obtained from interaction of 10 January transplanting with 150kg N ha^{-1}. The experimental findings suggest that 10 January transplanting with 150 kg N ha^{-1} is the best one in respect of grain yield.

Key words: Transplanting date, Nitrogen level, Yield, BRRI dhan28

INTRODUCTION

Data of transplanting is a vital factor, which affects considerably the grain yield of *boro* rice. Denish *et al.* (1997) reported that different planting dates significantly influenced the grain yield of rice. The vegetative development in indica cultivars is, in general, more affected by date of transplanting than other cultivars (Langfield and Basinki, 1960). Different workers throughout the world studied extensively the influence of date of transplanting on yield and yield contributing characters of rice. Many of them obtained better result from early transplanting than late transplanting (Ishikura *et al.*, 1968, Hedayetullah *et al.*, 1969, Singh *et al.*, 1969). Therefore, date of transplanting must be optimum to give higher crop yield.

On the other hand, the fertilizer element nitrogen plays a key role in rice production and it is required in larger amount compared with other fertilizers. Efficient fertilizer management gave higher yield of crop and reduced fertilizer cost (Hossain and Islam, 1986). Optimum dose of nitrogen fertilizer plays a vital role in growth and development of rice plant. Its growth is seriously hampered when lower dose of nitrogen is applied which drastically reduces yield. Further, excessive nitrogen fertilization encourages luxurious growth which makes the plant susceptible to insect, pest and diseases, which ultimately reduces yield. So it is essential to find out the optimum level of nitrogen for efficient utilization of this element by the plants for better yield. BRRI (1990) reported that nitrogen has a positive influence on the production of effective tillers plant^{-1}. Yield and yield attributes are also reported to increase with the application of nitrogen (Jashim and Ahmed, 1984). In vies of the above discussion, the present study was designed and conducted with a view to finding out the optimum transplanting date and nitrogen level of *Boro* rice cv. BRRI dhan28 to utilize its maximum production potential.

MATERIALS AND METHODS

The research work was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from December 2005 to May 2006 to study the production potential of *Boro* rice cv. BRRI dhan28 as affected by date of transplanting and nitrogen level. The experiment comprised two sets of treatments, namely, date of transplanting viz., 10 January, 20 January, 30 January, 10 February and 20 February 2006, and nitrogen level viz., 75, 100, 125 and 150kg N ha^{-1}. The design followed was randomized complete block design with three replications. The general soil type of the experimental field was Non-calcareous dark gray floodplain of Sonatola soil series under Old Brahmaputra Floodplain. The land was medium high with moderate drainage facilities and silt loam structure. Soil pH, OM, total N, available P, exchangeable K and available S content were 6.20, 1.67%, 0.10%, 26 ppm, 0.14% and 13.90 ppm, respectively. The size of unit plot was 4.0 m × 2.5 m. The experimental plot was fertilized with triple super phosphate, muriate of potash, gypsum and zinc sulphate as basal dose @ 125, 100, 55 and 11 kg ha^{-1}, respectively. Nitrogen (in the form of urea) was top dressed in three equal splits at 15, 30 and 45 days after transplanting according to treatments. Forty days old seedlings of *boro* rice were transplanted at the rate of three seedlings hill^{-1} with 25cm × 15cm spacing. Different intercultural operations such as gap filling, weeding and pesticide application were done as and when necessary. Five hills (excluding border hills) were randomly selected at maturity and uprooted from each unit plot prior to harvest for recording data on different plant characters. The crop was harvested at full maturity to record grain and straw yields. The recorded data were analyzed using the Analysis of Variance Technique. The mean differences were adjudged by Ducan's New Multiple Range Test.

Results and Discussion

Effect of date of transplanting

Date of transplanting exerted significant effect on all the parameters studied including grain and straw yields but not on 1000-grain weight (Table 1). It was observed that the tallest plant (91.68cm) was produced when transplanting was done on 10 January and then plant height was gradually decreased with delay in transplanting producing the shortest one (81.43cm) when transplanted on 20 February. Number of effective tillers hill^{-1} (14.60) also followed the similar trend with the highest value by 10 January transplanting and the lowest one (8.03) by 20 February transplanting. The longest panicle (22.99cm) was produced from 10 January transplanting which was statistically similar to 20 January (21.96cm), 20 February (20.96cm) and 10 February transplanting while the shortest one (17.60cm) was recorded when the crop was transplanted on 30 January. The highest number of grains panicle^{-1} (123.70) was observed in 10 January transplanting which was followed by 20 January transplanting (118.7) and thereafter it was decreased producing the lowest one (91.97) in 10 February transplanting which was statistically identical with 20 February (92.06) transplanting. The highest grain yield (4.61 t ha^{-1}) was obtained from 10 January transplanting. Grain yield was gradually decreased with delay in transplanting after 10 January. The lowest grain yield (2.95 t ha^{-1}) was recorded in 20 February planting. The highest number of effective tillers hill^{-1} and highest number of grain panicale^{-1} at 10 January transplanting resulted in the highest grain yield. Muthukrishnan *et al.* (2000) also reported that grain yield was reduced due to late transplanting compared to early planting. Om *et al.* (1993) also opined in the same tune. Straw yield was recorded the highest (5.08 t ha^{-1}) when transplanted on 20 January and it was identically followed by 10 January (4.91 t ha^{-1}) transplanting. The lowest straw yield (4.01 t ha^{-1}) was recorded in 20 February. The highest harvest index (48.67%) was also recorded from 10 January transplanting.

Effect of nitrogen level

Nitrogen level significantly influenced all the characters except panicle length, 1000-grain weight and harvest index (Table 2). Plant height increased gradually with the increased in nitrogen level. Plant attained maximum height (92.87cm) with 150 kg N ha^{-1} and the minimum one (81.75cm) with 75 kg N ha^{-1}. These results explicitly confirm the similar results obtained by Reddy *et al.* (1988). The increase in plant height with increased level of

Table 1. Effect of date of transplanting on the yield contributing characters and yield of *boro* rice cv. BRRI dhan28

Date of transplanting	Plant height (cm)	Effective tillers hill^{-1} (no.)	Non effective tillers hill^{-1} (no.)	Panicle length (cm)	Grains panicle^{-1} (no.)	Sterile spikelets panicle^{-1} (no.)	1000-grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
10 January	91.68a	14.60a	2.55ab	22.99a	123.70a	11.38c	21.56	4.61a	4.91a	48.67a
20 January	88.30b	12.28b	2.23b	21.96a	118.70a	12.90ab	21.48	4.19b	5.08a	45.67ab
30 January	85.24c	9.91c	1.76c	17.60b	103.70b	12.47b	21.43	3.54c	4.05b	46.56ab
10 February	85.31c	8.66d	2.73a	20.75a	91.79c	13.14a	21.50	3.28d	4.16b	44.23bc
20 February	81.43d	8.03d	2.60a	20.96a	92.06c	13.07ab	21.60	2.95e	4.01b	41.52c
$S_{\bar{x}}$	0.903	0.235	0.116	0.735	3.632	0.065	-	0.065	0.225	1.078
Level of sig.	**	**	**	**	**	**	NS	**	**	**
CV (%)	3.62	7.62	16.99	12.21	11.87	5.69	0.84	6.06	17.59	8.24

In a column the means having same letter (s) do not differ significantly by Duncan's New Multiple Range Test.
NS = Not significant
** = Significant at 1% level of probability.

nitrogen might be associated with stimulating effect of nitrogen on various physiological processes including cell division and cell elongation of the plant. The number of effective tillers hill^{-1} also increased with the increased level of nitrogen up to 150 kg N ha^{-1}. The highest number of effective tillers hill^{-1} (12.79) was produced when the crop was fertilized with 150 kg N ha^{-1} and the lowest one (8.82) was obtained from 75 kg N ha^{-1}. Adequacy of nitrogen probably favored the cellular activities during panicle formation and development which led to increased number of productive tillers hill^{-1}. Thakur (1991) and Ghosh *et al.* (1991) also agreed to this view. Increased level of nitrogen significantly increased the number of grains panicle^{-1} up to 100 kg N ha^{-1} and thereafter no response was observed. The highest number of grains panicle^{-1} (111.9) was recorded in 150 kg N ha^{-1} followed by 100 kg N ha^{-1} (108.00) and 125kg N ha^{-1} (106.2). The lowest one was recorded from 75 kg N ha^{-1} followed by 125 kg N ha^{-1} (106.2). Adequate supply of nitrogen contributed to grain formation which probably increased number of grains panicle^{-1} with increasing nitrogen level. The present results explicitly confirm similar results obtained by Chander and Pandey (1996). Grain yield was found to be increased gradually with the increased level of nitrogen. The highest grain yield (4.33 t ha^{-1}) was obtained from 150 kg N ha^{-1} and the lowest grain yield (3.06 t ha^{-1}) was obtained form 75 kg N ha^{-1}. The increased in grain yield from 150 kg N ha^{-1} might be due to the cumulative effect of the highest number of grains panicle^{-1} and highest number of effective tillers hill^{-1}. The results are in agreement with that of Singh *et al.* (2000). The highest straw yield (4.82 t ha^{-1}) was produced at 150 kg N ha^{-1} and it was identically followed by 125 kg N ha^{-1} (4.77 t ha^{-1}) and 100 kg N ha^{-1} (4.36 t ha^{-1}). The lowest one (3.82 t ha^{-1}) was produced by 75 kg N ha^{-1}. Similar trend of straw yield was also reported by Srivastava *et al.* (1987). Nitrogen influenced vegetative growth in terms of plant height and number of tillers hill^{-1} which resulted in increased straw yield.

Table 2. Effect of nitrogen level on the yield contributing characters and yield of *boro* rice cv. BRRI dhan28

Nitrogen level (Kg ha^{-1})	Plant height (cm)	Effective tillers hill^{-1} (no.)	Non effective tillers hill^{-1} (no.)	Panicle length (cm)	Grains panicle^{-1} (no.)	Sterile spikelets panicle^{-1} (no.)	1000-grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
75	81.75c	8.82c	2.16b	21.11	97.82b	12.24b	21.52	3.06d	3.82b	44.80
100	84.61b	10.48b	2.16b	21.22	108.00a	12.18b	21.47	3.58c	4.36ab	44.65
125	86.32b	10.70b	3.00a	19.35	106.20ab	12.31b	21.51	3.89b	4.77a	44.86
150	92.87a	12.79a	2.18b	21.71	111.90a	13.64a	21.56	4.33a	4.82a	46.99
$S_{\bar{x}}$	0.807	0.210	0.104	-	3.249	0.184	-	0.058	0.202	-
Level of sig.	**	**	**	NS	*	**	NS	**	**	NS
CV (%)	3.62	7.62	16.99	12.21	1.91	5.69	0.84	6.06	17.59	8.24

Table 3. Effect of interaction between date of transplanting and nitrogen level on the yield contributing
characters and yield of *boro* rice cv. BRRI dhan28

Interaction (T×N)	Plant height (cm)	Effective tillers hill^{-1} (no.)	Non effective tillers hill^{-1} (no.)	Panicle length (cm)	Grains panicle^{-1} (no.)	Sterile spikelets panicle^{-1} (no.)	1000-grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
$T_1 \times N_1$	85.24de	11.47def	2.13cde	22.50a	120.54	10.73g	21.69	4.29bcd	4.36	49.54
$T_1 \times N_2$	89.55bcd	13.60c	2.20cde	22.41a	122.16	11.38efg	21.37	4.50bc	4.66	49.10
$T_1 \times N_3$	92.46b	15.72b	3.46a	23.63a	123.16	11.06fg	21.45	4.56b	5.20	47.44
$T_1 \times N_4$	99.47a	17.60a	2.40cd	23.43a	128.89	12.33bcdef	21.72	5.10a	5.40	48.59
$T_2 \times N_1$	82.97e	10.27fgh	2.33cd	21.26a	121.54	13.04bcd	21.33	3.16fg	4.76	42.80
$T_2 \times N_2$	85.52cde	13.40c	1.66de	21.33a	127.22	12.03cdefg	21.63	4.65b	4.96	48.24
$T_2 \times N_3$	91.11bc	12.20cde	2.40cd	22.57a	110.36	13.23bc	21.41	4.46bc	5.10	46.62
$T_2 \times N_4$	93.60d	13.27c	2.53c	22.70a	135.66	13.31bc	21.53	4.50bc	5.50	45.00
$T_3 \times N_1$	82.55e	9.26hi	1.66de	20.18a	97.26	12.62bcde	21.53	3.03gh	3.80	44.47
$T_3 \times N_2$	82.96e	9.20hi	1.46e	20.47a	102.16	12.49bcde	21.41	3.23fh	3.73	46.51
$T_3 \times N_3$	82.07e	8.86hi	2.40cd	8.45b	101.76	12.36bcdef	21.35	3.86e	4.13	48.34
$T_3 \times N_4$	93.38b	12.33cd	1.53e	21.28a	113.70	12.41bcdef	21.45	4.03de	4.56	46.89
$T_4 \times N_1$	82.54e	6.60j	2.66bc	21.42a	93.31	12.37bcdef	21.34	2.66hi	3.06	46.49
$T_4 \times N_2$	81.37e	8.26i	2.73abc	20.39a	97.61	13.32bc	21.46	3.05gh	4.50	40.41
$T_4 \times N_3$	85.54cde	8.93hi	3.40ab	21.05a	100.44	13.24bc	21.67	3.48f	4.88	41.64
$T_4 \times N_4$	91.77b	10.87efg	2.13cde	20.14a	75.77	13.62b	21.55	3.45de	4.21	48.36
$T_5 \times N_1$	75.47f	6.53j	2.00cde	20.22a	76.45	12.46bcde	21.71	2.16j	3.13	40.73
$T_5 \times N_2$	83.67e	7.93ij	2.73bc	21.52a	91.00	11.67defg	21.48	2.48ij	3.95	39.00
$T_5 \times N_3$	80.45ef	7.80ij	3.33ab	21.07a	95.29	11.64defg	21.67	3.06gh	4.56	40.25
$T_5 \times N_4$	86.11cd	9.86gh	2.33cd	21.01a	105.49	16.52a	21.55	4.08cde	4.41	46.11
$S_{\bar{x}}$	1.806	0.470	0.233	1.470	-	0.413	-	0.130	-	-
Level of sig.	*	**	*	**	NS	**	NS	**	NS	NS
CV (%)	3.62	7.62	16.99	12.21	1.91	5.69	0.84	6.06	10.27	8.24

In a column the means having same letter (s) do not differ significantly by Duncan's New Multiple Range Test.

NS = Not significant,
* = Significant at 5% level of probability.
** = Significant at 1% level of probability.

T_1 = 10 January
T_2 = 20 January
T_3 = 30 January
T_4 = 10 February
T_5 = 20 February

N_1 = 75 kg ha^{-1}
N_2 = 100 kg ha^{-1}
N_3 = 125 kg ha^{-1}
N_4 = 150 kg ha^{-1}

Interaction effect of date of transplanting and nitrogen level

Interaction between date of transplanting and nitrogen level significantly influenced all the parameters under study except number of grain panicle^{-1}, 1000-grain weight, straw yield and harvest index (Table 3). The tallest plant (99.47cm) was found when transplanting was done on 10 January with 150 kg N ha^{-1} and the shortest one (75.47cm) was obtained when transplanting was done on 20 February with 75 kg N ha^{-1}. 10 January transplanting combined with 150kg N ha^{-1} produced the highest number of effective tillers hill^{-1} (17.60). The longest panicle (23.63cm) was produced by the interaction between 10 January transplanting and 125 kg N ha^{-1} followed by 10 January and 150 kg N ha^{-1} (23.43 cm). The shortest one (8.45cm) was produced by the treatment combination of 30 January and 125 kg N ha^{-1}. Grain yield was significantly influenced by interaction between date of transplanting and nitrogen level. The highest grain yield (5.10 t ha^{-1}) was found from the interaction between 10 January transplanting and 150 kg N ha^{-1}. The lowest one (2.16 t ha^{-1}) was obtained from the combination of 20 February transplanting × 75 kg N ha^{-1} and it was identically followed by 20 February transplanting × 100 kg N ha^{-1} (2.48 t ha^{-1}).

Conclusion

From the present study it may, therefore, be concluded that BRRI dhan28 should be transplanted on 10 January and 150 kg N ha^{-1} should be applied for obtaining higher grain and straw yields. However, further studies considering nitrogen level higher than 150 kg ha^{-1} are necessary to arrive at a concrete decision regarding nitrogen requirement of BRRI dhan28.

References

BRRI (Bangladesh Rice Research Institute). 1990. N response of promising variety. Ann. Rep. for Bangladesh Rice Res. Inst., Joydebpur., Gazipur. p. 95.

Chander, S. and Pandey, J. 1996. Effect of herbicide and nitrogen on yield of scented rice (*Oryza sativa*) under different rice cultures. Indian J. Agron. 41 (2): 209-214.

Denish, C., Lodh, S. B., Ehhoo, K. M. and Nanda, B. B. 1997. Effect of dates of planting and spacing on grain yield and quality of scented rice varieties in wet season in coastal Orissa. Indian J. Agric. Sci. 67 (3): 93-97.

Ghosh, B. C., Raghavaian, C. V. and Jana, M.K. 1991. Effect of seed level and nitrogen on growth and yield of direct sown rice (*Oryza sativa* L.) under intermediate deep water condition. Indian J. Agron. 36: 227-228.

Hedayetullah, S., Sen, S. and Nair, K. R. 1969. Influence of date of planting and spacing of some winter varieties of rice. Indian J. Agric. Sci. 14 (3): 248-259.

Hossain, S. M. A. and Islam, M.S. 1986. Fertilizer management in Bangladesh. Adv. Agron. Res. Joydebpur, Gazipur. pp. 48-54.

Ishikura, N., Komatsuo, Y. and Masuo, Y. 1968. Studies on the short period cultivation of dried sown rice plant. Crop. Sci. Soc. Japan. 37 (3): 329-334.

Jashim, C.U. and Ahmed, K.U. 1984. Response of rice varieties to applied nitrogen in saline soils. Intl. Rice. Res. Newsl. 9 (5): 22.

Langfield, E. C. B. and Basinki, J.J. 1960. The effect of time of planting on the behaviour of rice varieties in northern Austalia. Trop. Agric. Trin. 37 (4): 283-292.

Muthukrishnan, P., Ponnuswamy, K., Santhis, P, and Subramanian, M. 2000. Effect of transplanting time on the performance of rice hybrids in cauvery delfazone. Madras Agril. J. 87 (7-9): 506-507.

Om, H., Singh, O.P. and Joon, R.K. 1993. Effect of time of transplanting and spacing on Basmati rice, Haryana J. Agron. 9 (1): 87.

Reddy, M.D., Randa, M. M., Ghosh, B.C. and Reddy, B.B. 1988. Effect of nitrogen fertilizer on yield and nitrogen concentration in grain and straw of rice under semi deep water condition. J. Agril. Sci. 110 (1) : 53-59.

Singh, H. H., Gupta, J. C., Upadhay, B.D. and Srivastava, K. M. 1969. Newer rice planning date for Uttar Pradesh. Allahabad Farm. 43 (2): 239-241.

Singh, M.K., Thakur, R., Verma, U.N., Upasami, R. R. and Pal, S.K. 2000. Effect of planting time and nitrogen on production potential of Basmati rice (*Oryza sativa)* cultivars in Bihar plateau. Indian J. Agron. 45 (2): 303-304.

Srivastava, S. K., Singh, J. R. and Chandrawanshi, B. R. 1987. Nitrogen management for increasing N efficiency in transplanted rice. Intl. Rice Res. Newsl. 12: 4-51.

Thakur, R. B. 1991. Response of summer rice (*Oryza sativa)* to nitrogen. Indian J. Agron. 36: 229-230.