

EFFECT OF NITROGEN AND SPACING ON THE YIELD AND YIELD CONTRIBUTING CHARACTERS OF BORO RICE (cv. BRRI Dhan28)

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ABSTRACT

An experiment was conducted at the Agronomy Field laboratory, Bangladesh Agricultural University, Mymensingh to study the effect of nitrogen and spacing on the yield and yield contributing characters of Boro rice cv. BRRI Dhan28. The experiment consisted of four nitrogen levels, viz. 0, 80, 100 and 120 kg ha⁻¹ and three spacing viz. 20 cm × 15 cm, 25 cm × 15 cm and 30 cm × 15 cm. The experiment was laid out in a randomized complete block design with three replications. Nitrogen level significantly influenced the plant height, number of effective tillers hill⁻¹, number of total tillers hill⁻¹, panicle length, grain yield and straw yield except 1000-grain weight. The highest grain yield (5.21 t ha⁻¹) was recorded from 100 kg N ha⁻¹, and the lowest (4.26 t ha⁻¹) from 0 kg N ha⁻¹ or control treatment. Spacing significantly influenced all the yield and yield contributing characters except also 1000-grain weight. The highest grain yield (5.21 t ha⁻¹) was recorded from the spacing 25 cm × 15 cm whereas the lowest grain yield (4.21 t ha⁻¹) was obtained from the spacing 20 cm × 15 cm. The highest grain yield (5.71 t ha⁻¹) and the harvest index (45.98%) were obtained from the interaction of 100 kg N ha⁻¹ with 25 cm × 15 cm spacing. The highest straw yield (7.08 t ha⁻¹) was obtained from the interaction of 120 kg N ha⁻¹ with 30 cm × 15 cm spacing. The lowest (3.59 t ha⁻¹) grain yield was obtained from the control treatment with 20 cm × 15 cm spacing.

Key words: Nitrogen, spacing, boro rice, yield.

Introduction

Boro rice is one of the most important rice crops for Bangladesh with respect to its high yield and contribution to rice production. The highest average rice yield achieved in *boro* season 3.63 t ha⁻¹ compared to 2.02 t ha⁻¹ and 1.53 t ha⁻¹ in *aman* and *aus* season, respectively (BBS, 2004). Proper management practices are the most effective means for increasing yield of boro rice. The qualities of boro rice along with its quantity are supposed to be increased by the spacing arrangements. Efficient fertilizer management gave higher yield of crop and reduced fertilizer cost (Hossain and Islam, 1986). Optimum dose of nitrogen fertilization 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 reduced yield. Further, excessive nitrogen fertilization encourages excessive vegetative growth which make the plant susceptible to insect, pest and diseases which ultimately reduces yield. So it is essential to find out the optimum rate of nitrogen application 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 per plant, yield and yield attributes are also reported to increase with the application of nitrogen (Jashim and Ahmed, 1984). Plant spacing is also an important factor that needs to be considered during transplanting of rice. The growth, yield and yield components of rice are also greatly influenced by plant spacing. Under field condition farmers are using variable plant spacing for boro rice cultivation. Some of them use very closer plant spacing and others are using wider plant spacing. Optimum plant spacing ensures the plants to grow properly both in their aerial and underground parts through efficient utilization of solar radiation and nutrients (Miah *et al.*, 1990). Proper spacing may help receive maximum light interceptions etc. are better for photosynthesis as well as yield of rice. Therefore, spacing must be optimum for higher crop yield. Under the above

circumstances, a research trial was conducted with the following objectives: i) to study the effect of spacing on the yield of boro rice ii) to see the effect of nitrogen level and iii) to find out the interaction effect of spacing and nitrogen level, if any, on the yield of boro rice cv. BRRI Dhan28.

Materials and Methods

An experiment was conducted at the Agronomy Field laboratory, Bangladesh Agricultural University, Mymensingh during the period to determine the effect of nitrogen and spacing on the performance of Boro rice cv. BRRI Dhan28. The experiment comprised of two factors-(a) four levels of nitrogen levels, viz. 0, 80, 100 and 120 kg N ha⁻¹ and (b) three plant spacing viz. 20 cm× 15 cm, 25 cm× 15 cm and 30 cm× 15 cm. The experiment was laid out in a randomized complete block design with three replications. The unit plot was 10 m² (4.0 m × 2.5 m). The experimental plot was fertilized with triple superphosphate, muriate of potash, gypsum and zinc sulphate as basal dose @ 1230, 70, 60 and 10 kg N ha⁻¹, respectively. Nitrogen fertilizer was top dressed in the form of urea in three equal splits at 15, 30 and 45 days after transplanting according to treatments. Seedlings were transplanted on January of the year. Intercultural operations were done as and when necessary. The data were recorded on yield characters. The collected data were analyzed statistically and the mean differences were adjudged by Duncan's New Multiple Range Test at 1% and 5% level of significance.

Results and Discussion

Effect of Nitrogen: Different levels of nitrogen had significant effect on most of the parameters (Table 1). BRRI dhan28 produced the highest plant height (82.52 cm), number of total tillers hill⁻¹ (11.37) and panicle length (20.95 cm) at 120 kg N ha⁻¹. The highest number of effective tillers hill⁻¹ (9.24), total grains (100.18), 1000-grain weight (22.66 g), grain yield (5.21 t ha⁻¹), straw yield (6.59 t ha⁻¹), and harvest index (44.12%) were obtained from 100 kg N ha⁻¹. The control treatment produced the lowest results for all the characters under the study. This result is in agreement with the findings of Chopra and Chopra (2004). Similar results were found from the findings of Singh *et al.* (2000).

Table 1. Effect of levels of nitrogen on the yield and yield contributing characters of boro rice cv. BRRI dhan28

Level of nitrogen (kg ha ⁻¹)	Plant height (cm)	Effective tillers hill ⁻¹ (no.)	Total tillers hill ⁻¹ (no.)	Panicle length (cm)	Total grains panicle ⁻¹ (no.)	1000-grain weight (g)	Grain yield (tha ⁻¹)	Straw yield (tha ⁻¹)	Harvest index (%)
N0	72.21c	7.24b	9.13b	19.50c	75.33d	22.50	4.26d	5.69c	42.74c
N1	75.62b	8.72a	10.92a	20.20b	86.78c	22.59	4.86c	6.22b	43.79ab
N2	77.09b	9.24a	11.32a	20.37b	100.18a	22.66	5.21a	6.59a	44.12a
N3	82.52a	8.86a	11.37a	20.95a	91.83b	22.56	5.04b	6.58a	43.30bc
Level of sig.	**	**	**	**	**	NS	**	**	**
Sx	0.51	0.19	0.22	0.09	0.53	-	0.04	0.03	0.20
CV (%)	10.01	6.62	6.11	8.42	5.79	5.82	6.31	7.25	7.37

In a column, the means having same letter (s) do not differ significantly at 5% level of significance by DMRT.

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

N0=0 kg N ha⁻¹ or Control, N1=80 kg N ha⁻¹, N2=100 kg N ha⁻¹, N3=120 kg N ha⁻¹.

Effect of spacing: Spacing had significant effect on yield contributing characters except 1000-grain weight. The highest plant height (77.82 cm) was observed when the crop was transplanted in 25 cm× 15 cm spacing and the lowest plant height (76.32 cm) from 20 cm× 15 cm spacing (Table 2). The highest number of total tillers hill⁻¹ (11.70) and effective tillers hill⁻¹ (9.62) were obtained from 25 cm× 15 cm spacing. BRRI dhan28 produced the highest number of total grains panicle⁻¹ (94.00), grain yield (5.21 t ha⁻¹) and harvest index (44.71%) when the plant transplanted in 25 cm× 15 cm spacing and the lowest (4.21 t ha⁻¹) grain yield was obtained from 20 cm× 15 cm spacing. The highest panicle length (20.57 cm) and straw yield

(6.61 t ha⁻¹) were found from 30 cm× 15 cm spacing and the lowest from 20 cm× 15 cm spacing. Similar findings were supported by Ramakrishna *et al.* (1992).

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

Spacing	Plant height (cm)	Effective tillers hill ⁻¹ (no.)	Total tillers hill ⁻¹ (no.)	Panicle length (cm)	Total grains panicle ⁻¹ (no.)	1000-grain weight (g)	Grain yield (tha ⁻¹)	Straw yield (tha ⁻¹)	Harvest index (%)
S1	76.32b	6.97c	8.90b	19.78c	82.96c	22.50	4.21c	5.77c	42.14c
S2	77.82a	9.62a	11.70a	20.08b	94.00a	22.67	5.21a	6.43b	44.71a
S3	76.44b	8.97b	11.46a	20.57a	88.63b	22.57	5.11b	6.61a	43.61b
Level of sig.	*	**	**	**	**	NS	**	**	**
Sx	0.45	0.16	0.19	0.18	0.46	-	0.03	0.02	0.17
CV (%)	10.01	6.62	6.11	8.42	5.79	5.82	6.31	7.25	7.37

Table 3. Interaction effect of nitrogen and spacing on the yield and yield contributing characters of boro rice

Nitrogen x Spacing	Plant height (cm)	Effective tillers hill ⁻¹ (no.)	Total tillers hill ⁻¹ (no.)	Panicle length (cm)	Total grains panicle ⁻¹ (no.)	1000-grain weight (g)	Grain yield (tha ⁻¹)	Straw yield (tha ⁻¹)	Harvest index (%)
N0S1	71.43g	6.20g	7.47f	18.69	72.65h	22.43	3.59g	5.11h	41.22e
N1S1	75.07ef	7.00fg	9.33e	19.89	80.47f	22.60	4.30f	5.76g	42.73d
N2S1	76.43de	7.13fg	9.07e	19.81	93.72c	22.48	4.61e	6.10e	43.04d
N3S1	82.33b	7.53ef	9.73e	20.72	85.00e	22.48	4.34f	6.09e	41.57e
N0S2	71.33g	8.27de	10.13de	19.07	77.69g	22.52	4.57e	5.92f	43.56cd
N1S2	78.37cd	10.23ab	12.43ab	19.96	90.85d	22.43	5.20cd	6.53c	44.31bc
N2S2	81.57b	10.67a	12.80a	20.47	106.88a	22.85	5.71a	6.71b	45.98a
N3S2	80.03bc	9.32bc	11.45bc	20.81	100.56b	22.87	5.37bc	6.57c	44.97ab
N0S3	73.87efg	7.27ef	9.80e	19.40	75.64g	22.55	4.63e	6.03ef	43.42cd
N1S3	73.43fg	8.94cd	11.01cd	20.74	89.10d	22.75	5.08d	6.38d	44.32bc
N2S3	73.24fg	9.93abc	12.10abc	20.82	99.95b	22.66	5.32bc	6.96a	43.34cd
N3S3	85.20a	9.73abc	12.93a	21.32	98.92d	22.34	5.42b	7.08a	43.36cd
Level of sig.	**	*	*	NS	**	NS	*	**	**
Sx	0.89	0.33	0.38	-	0.91	-	0.07	0.04	0.34
CV (%)	10.01	6.62	6.11	8.42	5.79	5.82	6.31	7.25	7.37

In a column, the means having same letter (s) do not differ significantly at 5% level of significance by DMRT.

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

N0=0 kg N ha⁻¹ or Control, N1=80 kg N ha⁻¹, N2=100 kg N ha⁻¹, N3=120 kg N ha⁻¹.

S1=20 cm × 15 cm, S2=25 cm × 15 cm, S3=30 cm × 15 cm

Interaction effect of nitrogen and spacing: Results revealed that the interaction between nitrogen level and spacing had no significant effect in respect of panicle length and 1000-grain weight. Significantly the highest plant height (85.20 cm), number of total tillers hill⁻¹ (12.93) and straw yield (7.08 t ha⁻¹) were found from 120 kg N ha⁻¹ with 30 cm× 15 cm spacing. The highest number of effective tillers hill⁻¹ (10.67), number of total grains panicle⁻¹ (106.88), grain yield (5.71 t ha⁻¹) and harvest index (45.89%) were obtained from the interaction of 100 kg N ha⁻¹ with 25 cm× 15 cm spacing (Table 3).

Conclusion

Based on the findings of the present study, it can be concluded that the use of 100 kg N ha⁻¹ with 25 cm× 15 cm spacing would be a promising practice to maximize the grain yield of boro rice cv. BRRI dhan28.

References

- BBS (Bangladesh Bureau of Statistics), 2004. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics, Stat. Div. Minis. Plan. Govt. People's Rep. Bangladesh, Dhaka. pp. 136-140.
- BRRI (Bangladesh Rice Research Institute). 2000. Annual Report for 1999. BRRI. Joydebpur, Gazipur, Bangladesh, pp. 8-9.
- Chopra, N. K. and Chopra, N. 2000. Effect of row spacing and N level on growth, yield and seed quality of scented rice (*Oryza sativa*) under transplanted conditions. *Indian. J. Agron.*, 45(2): 304-308.
- Hossain, S. M. A. and Islam, M. S. 1986. Fertilizer management in Bangladesh. *Adv. Agron. Res.* in Joydebpur, Gazipur. pp. 48-54.
- 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.
- Miah, M. N. H., Karim, M. A., Rahman, M. S. and Islam, M. S. 1990. Performance of Nizersail mutants under different row spacing. *Bangladesh J. Training and Dev.*, 3(2): 31-34.
- Ramakrishna, T.A., Shivaraj, B. and Gowda, A. 1992. Effect of planting date, seedling age and spacing on yield of rice. *Current Res. Univ. Agril. Sci. Bangalore.* 21(4): 63-64.
- 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): 303-303.