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EFFECT OF VARIETY AND SPACING ON THE GROWTH AND YIELD OF TRANSPLANT *AUS* RICE

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ABSTRACT

A research work was carried out at the Agronomy Field Laboratory, Department of Agronomy, Bangladesh Agricultural University, Mymensingh, durin April to September 2008 to study the effect of variety and spacing on the growth and yield of transplant *Aus* rice. The experiment consisted of three rice varieties viz. BR3, BR14 and BR26 and four spacings viz. 25 cm × 15 cm, 20 cm × 20 cm, 20 cm × 15 cm and 20 cm × 10 cm. The experiment was laid out in a split-plot design with three replications assigning spacings in the main plots and varieties in the sub-plots. Plant height was significantly influenced by variety and spacing during the vegetative growth phase. BR26 produced the tallest plant. The number of tillers hill^{-1} was the highest in BR14 and was the lowest in BR26 variety. The plant height was the highest with 20 cm × 20 cm spacing. BR26 with 20 cm × 20 cm spacing produced the tallest plant. BR14 with 25 cm × 15 cm spacing produced maximum number of tillers hill^{-1} while BR26 produced minimum number of tillers hill^{-1}. At maturity most of the parameters significantly influenced by variety and spacing. Spacing of 20 cm × 10 cm produced the highest grain yield (4.23 tha^{-1}), biological yield (9.56 tha^{-1}) and harvest index (44.11%).The tallest plant was obtained in BR26 but the highest grain yield and biological yield were obtained in BR14 with the spacing of 20 cm × 10 cm. Results depicted that BR14 with the spacing of 20 cm × 10 cm appeared as the promising practice to maximize the yield of transplant *Aus* rice.

Key words: Variety, spacing, *Aus* rice.

Introduction

There are three distinct growing seasons of rice namely, *Aus*, *Aman* and *Boro* in Bangladesh and the production of rice in *Aus*, *Aman* and *Boro* seasons are 150.04, 981.96 and 1383.70 million ton, respectively (BBS, 2006). Aus rice is cultivated on 8.9% of the total cropped area of Bangladesh (BBS, 2006). So among these three seasons, rice production in Aus season is the least and efforts should be made to increase the production of *Aus* rice. The horizontal expansion of rice area in Bangladesh is not possible due to heavy population pressure. So the only avenue left is to increase the production of rice through vertical expansion. Optimum planting densities as well as improved varieties are two of the most effective means to increase the yield of transplant *Aus* rice. Spacing has important role on growth, yield and yield components of transplant *Aus* rice. Optimum plant spacing ensures the plants to grow properly with their aerial and underground parts utilizing more solar radiation and nutrients (Miah *et al.,* 1990).Variety itself is the genetical factor which contributes a lot for producing yield and yield components. Yield is the product of some components, such as number of effective tillers hill^{-1}, number of grains panicle^{-1} and weight of individual grain. These components are directly related to the variety and the neighboring environments on which it grows. Bangladesh Rice Research Institute (BRRI) has released 50 modern varieties (MV) of rice suitable for cultivation in one or more of the three rice growing seasons of Bangladesh. Each variety has certain tiller producing capacity, adequate number of effective tillers per unit area exert a role in producing panicle number and the spikelets number. Panicle number per unit area and the fertile spikelets per panicle are the most important yield components in rice. Optimum number of tillers per unit area is a prerequisite for obtaining maximum yield from a rice variety and rice yield increases with increased number of panicles per unit area (BRRI, 1992). The growth and yield of these varieties are directly related to plant spacing. Higher yield could be achieved from these varieties if they are properly spaced and managed. Optimum spacing varies not only with genotype having different growth habit but also with season, soil and climate (Have, 1992). Experiments on the spacing of transplant rice are going on here in Bangladesh and abroad to find out the suitable plant population in order to get maximum yield. Modern rice varieties such as BR3, BR14, BR26, BRRI dhan27 and BRRI dhan29 and other promising lines could be suitable for cultivation in Bangladesh in *Aus* season. So, adjustment of optimum planting density with suitable varieties may be considered as an important means to increase the yield of transplant *Aus* rice. With this end in view, the present study was undertaken with the objectives: i) to find out the major components of productivity of the crop pertaining to the physiological attributes, ii) to find out the optimum planting density on transplant *Aus* rice and iii) to evaluate the performance of different rice varieties at various planting density and sorting out varieties suitable for a particular plant density.

Materials and Methods

The research work was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from April to September, 2008 in order to find out the effect of variety and spacing on the growth and yield of transplant *Aus* rice. The experiment consisted of three rice varieties viz. BR3, BR14 and BR26 and four spacing's viz. 25cm × 15cm (S_1), 20cm × 20cm (S_2), 20cm x 15cm (S_3) and 20cm × 10cm (S_4). The size of each unit plot was 4.0m × 2.5m and the spaces between blocks and plots were 1 m and 0.25m, respectively. The experiment was laid out in a split plot design with three replications. The land was fertilized with recommended doses of urea, triple super phopsphate, muriate of potash and gypsum, respectively. The whole amount of TSP, MP and Zinc sulphate were applied as basal dose before transplanting. Urea was top dressed in three equal splits at 15, 30 and 45 days after transplanting (DAT). Intercultural operations such as, fertilization, weeding, watering and pest management were done as and when necessary. Data on growth parameters were recorded at15day intervals starting from 30 DAT to 60 DAT. Harvesting was done when 90% of the grains became golden in colour. Five hills were randomly selected from each unit plot prior to harvest for recording data on yield components. Data were analyzed statistically using "Analysis of Variance" (ANOVA) technique and the differences among treatments were adjudged by Duncan's New Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Results and Discussion

Effect of Varity

The experiment revealed that BR26 produced the tallest plant (118.17cm) at maturity followed in order by BR14 (111.46cm) and BR3 (95.96cm), respectively. The shortest plant height was produced by BR3 (95.96cm) (Table 1). The result revealed that varieties had great influence on the plant height and the height of the plant depends on the variety and it was due to heredity or varietal character.

Table 1. Effect of variety on different yield and yield contributing characters of transplant *Aus* rice

Variety	Plant height (cm)	No of effective tillers hill^{-1}	Panicle length (cm)	No of grains panicle^{-1}	1000- grain weight (g)	Grain yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
BR3	95.96c	8.82b	25.52a	122.01b	25.14	3.39b	8.08b	41.97b
BR14	111.46b	11.86a	24.36b	133.06a	25.33	4.09a	9.45a	43.06a
BR26	118.17a	9.63b	24.20b	110.46c	24.96	3.07c	7.75c	39.33c
S $\bar{X}$	1.34	0.15	0.23	0.23	0.39	0.02	0.05	0.16
Level of significance	**	**	**	**	NS	**	**	**

In a column, the means having similar letter (s) or without letter (s) do not differ significantly and those having dissimilar letter (s) differ significantly as per DMRT, ** = Significant at 1% level of probability, NS = Not significant.

The highest number of tillers hill^{-1} (16.49) was observed in BR14. Variety had significant effect on most of the parameters studied at maturity except weight of 1000 grains. BR14 produced the maximum number of effective tillers hill^{-1} (11.86), number of grains panicle^{-1} (133.06), 1000-grain weight (25.33g), biological yield (9.45 t ha^{-1}) and harvest index (43.06%). BR14 produced the highest grain yield (4.09 t ha^{-1}) followed by BR3 (3.39 t ha^{-1}). The lowest grain yield was obtained from BR26 (3.07 t ha^{-1}). The probable reasons for variation in yield was due to the genetic makeup of the variety which influenced by the heredity and environmental factors. Similar results were also obtained by Alam (1988).

Effect of Spacing

The highest plant height (103.64cm) was observed at 20 cm × 20 cm which was closely followed by those of 25cm × 15cm, 20 cm × 15 cm and 20 cm × 10 cm, respectively. The result was consistent with the result of Shah *et al.,* (1991) who found increased plant height at wider spacing. Plant height was not significantly affected by the interaction between variety and spacing at maturity. Number of tillers $hill^{-1}$was significantly influenced due to different spacings. All parameters studied at harvest were significantly influenced due to spacing except plant height and weight of 1000 grains. The 20 cm x 20 cm spacing produced the tallest plant, maximum number of effective tillers $hill^{-1}$ (13.76), panicle length (25.37cm), number of grains $panicle^{-1}$ (136.63).

Table 2. Effect of spacing on different yield and yield contributing characters of transplant *Aus* rice

Spacing	Plant height (cm)	No of effective tillers $hill^{-1}$	Panicle length (cm)	No of grains $panicle^{-1}$	1000- grain weight (g)	Grain yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
S_1	98.84	8.97c	24.36ab	124.59b	25.37	2.76d	6.97d	39.60d
S_2	103.64	13.76a	25.37a	136.63a	24.83	3.38c	8.33c	40.35c
S_3	100.23	10.40b	23.98b	115.84c	25.25	3.70b	8.85b	41.75b
S_4	97.76	7.28d	25.06ab	110.31d	25.14	4.23a	9.56a	44.11a
$S\bar{X}$	1.54	0.38	0.35	0.78	0.34	0.02	0.06	0.19
Level of significance	NS	**	**	**	NS	**	**	**

S_1 = 25cm × 15cm, S_2 = 20cm × 20cm, S_3 = 20cm x 15cm and S_4 = 20cm × 10cm

In a column, the means having similar letter (s) or without letter (s) do not differ significantly and those having dissimilar letter (s) differ significantly as per DMRT, ** = Significant at 1% level of probability, NS = Not significant.

The highest grain yield (4.23 t ha^{-1}) was obtained at the closest spacing (20 cm ×10 cm) and the lowest gain yield (2.76 t ha^{-1}) from the spacing (25cm × 15cm) (Table 2). The second highest grain yield (3.70 t ha^{-1}) was obtained from 20 cm ×15 cm spacing. The grain yield at 20 cm × 20 cm (3.38t ha^{-1}) occupied the third position. Closer spacing showed higher grain yield and wider spacing showed lower grain yield. Probably the reason was that closer spacing produced maximum number of effective tillers $unit^{-1}$ area compared to wider spacing. Similar results were obtained by Islam *et al*. (1994) and Padmajarao (1995).20 cm x 10 cm spacing also produced the highest biological yield (9.56 tha^{-1}) and harvest index (44.11%).

Interaction effect

The highest plant height (119.74 cm) was found in BR26 with the spacing of 20cm × 20cm and the lowest (94.67 cm) in BR3 with the spacing of 20cm × 10cm.The interaction of variety and spacing had significant effect on number of total grains $panicle^{-1}$, grain yield, biological yield and harvest index except plant height, number of effective tillers $hill^{-1}$, panicle length and weight of 1000 grain. The highest grain yield (5.02 t ha^{-1}) was obtained from 20cm × 10cm spacing with BR14 and the lowest gain yield (2.40t ha^{-1}) was obtained from the spacing 25cm × 15cm with BR26 variety, which was statistically different from other spacings (Table 3).The highest biological yield was obtained from BRl4 with the spacing of 20 cm ×10 cm than BR3 and BR26 with the spacing of 20 cm × 20 cm.

Table 3. Interaction effect of variety and spacing on different yield and yield contributing characters of T. *Aus* rice

Interaction (Variety × Spacing)	Plant height (cm)	No of effective tillers hill^{-1}	Panicle length (cm)	No of grains panicle^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
BR3×S_1	96.05	8.33	24.33	114.90f	25.17	2.89h	6.94h	41.62d
BR3× S_2	96.32	11.35	27.11	120.89e	24.95	3.45e	8.01f	43.10bc
BR3× S_3	94.67	7.60	24.87	124.31de	25.98	3.32f	8.34e	39.75e
BR3× S_4	96.81	6.53	25.77	97.54g	25.22	3.92c	9.03d	43.40b
BR14× S_1	112.47	12.45	24.53	127.95cd	24.65	3.00g	7.44g	40.34e
BR14× S_2	112.87	15.30	24.46	144.68a	24.83	3.97c	9.40c	42.26cd
BR14× S_3	111.75	9.07	23.76	116.15f	25.55	4.38b	10.12b	43.30b
BR14× S_4	110.78	12.40	24.68	137.27b	25.98	5.02a	10.83a	46.35a
BR26× S_1	117.01	7.27	24.22	125.14cd	24.95	2.40j	6.53i	36.84f
BR26× S_2	119.74	8.27	24.54	129.09c	24.70	2.71i	7.59g	35.68g
BR26× S_3	1118.27	9.67	23.32	133.32b	25.37	3.41ef	8.08ef	42.21cd
BR26× S_4	116.68	13.59	24.73	90.90h	24.40	3.75d	8.82d	42.57bcd
S $\overline{X}$	2.67	0.65	0.61	1.34	0.58	0.04	0.10	0.32
Level of significance	NS	NS	NS	**	NS	**	**	**

S_1 = 25cm × 15cm, S_2 = 20cm × 20cm, S_3 = 20cm x 15cm and S_4 = 20cm × 10cm

In a column, the means having similar letter (s) or without letter (s) do not differ significantly and those having dissimilar letter (s) differ significantly as per DMRT, ** = Significant at 1% level of probability, NS = Not significant.

Conclusion

A suitable variety and an optimum spacing of rice play a remarkable role for the improvement of growth and yield of transplant *Aus* rice. Among the four spacings, 20 cm × 10 cm appeared to be the best spacing and BR14 was found to be a promising rice variety for higher grain yield as transplant *Aus* rice.

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