J. Agrofor. Environ. 3 (1): 85-88, 2009 ISSN 1995-6983

Effects of spacing on the performance of six hybrid rice lines in boro season

M.Z. Haque, M.S.U. Bhuiya, S.M.A. Hossain and S. Barman
Department of Agronomy, Bangladesh Agricultural University, Mymensingh-2202

Abstract: A research work was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from December 2007 to May 2008 in order to find out the effect of spacing on the performance of hybrid rice lines in *boro* season. The experiment consisted of six hybrid lines viz. ACI Line1, ACI Line2, ACI Line3, ACI Line4, ACI Line5 and ACI Line6 and three spacings viz. 25 cm × 25 cm, 20 cm × 20 cm and haphazard planting. The experiment was laid out in split-plot design with three replications. The highest number of total tillers hill^{-1} (13.90), number of effective tillers hill^{-1} (12.83), number of grains panicle^{-1}(184.28), panicle length (24.86 cm), grain yield (6.66 t ha^{-1}) and straw yield (7.13 ha^{-1}) were obtained from ACI Line5. The number of total tillers hill^{-1} (13.19), number of effective tillers hill^{-1} (11.85), number of grains panicle^{-1}(166.63), grain yield (5.84 t ha^{-1}) and straw yield (6.35 ha^{-1}) were highest in spacing 20 cm × 20 cm. No significant effect was noticed due to interaction of hybrid rice line and spacing. Numerically ACI line5 produced more yield at a spacing of 20 cm × 20 cm.
Key words: Boro rice, ACI Hybrid rice line, Spacing, Grain yield

Introduction

Rice is the major food crop of Bangladesh covering about 80 percent of total cropped area. It is grown in more than hundred countries across the world. In 2004-2005, 10.37 million hectares of land of the country is under rice cultivation which produces 25.17 million tons of rice (BBS, 2006).

Bangladesh has been facing acute shortage of rice for a long time but presently she has fulfilled her annual demand with a surplus of 2.5 million metric tons. Three rice growing seasons is distinctly appeared in Bangladesh namely *aus*, *aman* and *boro*. The average yield of rice in *aus*, *aman* and *boro* seasons are 0.61, 3.97 and 5.60 metric tons ha^{-1}, respectively (BBS, 2006). Among these three seasons, *boro* rice covers an area of 4.06 million hectares with a production of 13.06 million tons of grains (BBS, 2006). The horizontal expansion of rice area in the country is not possible due to increasing population pressure.

The average yield of rice is poor in Bangladesh, only 2.43 t ha^{-1} (BBS, 2006). The yield of *boro* rice is, however, higher than that of *aman* rice. On the other hand, rice production area is decreasing day by day due to high population pressure. As there is very little scope of horizontal expansion of crop production in Bangladesh, farmers and agricultural scientists are diverting their attention towards vertical expansion for increased yield of crop. Therefore, attempts should be taken to increase the yield per unit area. For vertical expansion, the use of modern production technologies should be included, such as, use of quality seeds, high yielding and hybrid varieties/lines, fertilizer management, optimum age of seedlings, seedling raising techniques and so on.

Cultivar is the most important factor in rice production. The use of modern yielding variety has been increased remarkably in recent years and the country has already reached a level of self sufficiency in food. The lion share of this self-sufficiency is mainly the contribution of expansion of modern varieties of rice in the *boro* season. A number of rice cultivars are grown by the farmers in Bangladesh. However, many of them are not known to us which need to be studied for yield and yield contributing characters. Bangladesh Rice Research Institute and Bangladesh Institute of Nuclear Agriculture released few cultivars to cultivate in *boro* season. Besides these, some seed companies are distributing seeds of hybrid rice varieties ans lines. Detailed studies of these varieties/lines are necessary to furnish worth information regarding yield and yield components of them.

Spacing is another important factor that influences the growth, development and yield of *boro* rice. Closer spacing not only hampers intercultural operation but also creates more competition among the plants for nutrients and light resulting in reduced yield. Optimum plant spacing ensures the plant to grow properly with their aerial and underground parts by utilizing more solar radiation and nutrients (Miah *et al*., 1990). It was reported that the highest grain yield of 4.88 t ha^{-1} was documented with spacing 20 cm × 20cm (Rafiq *et al*. 1998). The plant spacing when exceeds an optimum level, competition for the growth factors among the pants becomes severe. Consequently, the plant growth slows down and ultimately the grain yield decreases. The tillering and production habit depend to a great extent on the spacing of transplanting, which is responsible for the variation in yield of rice unit^{-1} area. Therefore, the present study was undertaken to see the effects of spacing on the performance of six hybrid rice lines in boro season.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University (BAU), Mymensingh during the period from December 2007 to June 2008. The land was medium high having sandy loam soil and belongs to Sonatola series under the non - calcareous dark-grey floodplain soil of Old Brahmaputra floodplain AEZ-9 (UNDP and FAO, 1988). The experiment consisted of two factor, Spacing viz. 25 cm × 25 cm ; 20 cm × 20 cm and haphazard planting, and

Hybrid line viz. ACI Line1; ACI Line2; ACI Line3; ACI Line4; ACI Line5; ACI Line6.The experiment was laid out in a split plot design having hybrid line in the main plot and spacing in the sub-plot with three replications. The unit plot size was 10 m^2 (4 m × 2.5 m).Well decomposed cowdung was applied in unit plots at the rate of 5 t ha^{-1} on 15 January 2007. Fertilizers were applied to the plots at the rate of 308.75, 123.5, 148.2, 83.24and 11.2 kg ha^{-1} in the forms of urea, tripple super phosphate, muriate of potash, gypsum and zinc sulphate, respectively. After the emergence of seedlings, gap filling was done. Three weedings were done to control weeds. The crop was harvested at full maturity, the harvested crop was brought to the threshing floor and dried in the sun for three days .The seeds and straw were separated and

cleaned .The cleaned seeds were dried in sun for 3-4 consecutive days. The seed yield was adjusted at 12 % moisture level. The data on yield contributing characters were recorded from 5 randomly selected plants from each plot. Seed yield and straw yield were recorded from individual plot and were converted to hectare basis. The data were analyzed statistically using the analysis of variance with the help of computer package MSTAT and mean differences were adjudged by Duncan Ranged Test (Gomez and Gomez, 1984).

Results and Discussion

Hybrid rice line showed significant differences on all parameter except plant height (cm), number of non-effective tillers hill $^{-1}$ and harvest index. The highest grain yield (6.6 t ha^{-1}) was recorded in the ACI line5. The highest grain yield in the ACI line5 was attributed to the highest number of total tillers hill^{-1}, number of effective tillers hill^{-1}, panicle length (cm), grain yield (t ha^{-1}), straw yield (t ha^{-1}) and biological yield (t ha^{-1}). The lowest grain yield (4.56 t ha^{-1}) was produced by the ACI line1. The highest straw yield (7.13 t ha^{-1}) and biological yield (13.78 t ha^{-1}) was produced by the ACI line5. ACI line5 produced the highest number of total tillers hill^{-1} (13.90), number of effective tillers hill^{-1} (12.83) and panicle length (24.86 cm). The highest number of grains panicle-1 (184.98) was produced by the ACI line6 which was statistically identical with ACI line5.The highest 1000-grain weight (32.24 g) was recorded in the ACI line4 (Table 1).

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

Hybrid Line	No. of total tillers hill^{-1}	No. of effective tillers hill^{-1}	Panicle length (cm)	No. of grains panicle^{-1}	No. of sterile spikelets panicle^{-1}	No. of total grains pancile^{-1}	1000 grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})
L_1	10.62 c	9.51bc	23.99b	142.58c	10.31c	152.89d	30.16c	4.56d	5.05d	9.60d
L_2	13.60 a	12.44a	23.91b	109.56d	12.75b	122.31e	31.67b	4.78d	5.35d	10.13d
L_3	11.09 bc	9.84b	24.70a	178.81a	7.85d	186.66c	28.64e	5.83b	6.38b	12.21b
L_4	10.53 c	9.02c	24.49a	170.47b	8.29d	178.76c	32.24a	5.33c	5.88c	11.22c
L_5	13.90 a	12.83a	24.86a	184.28a	14.08b	198.35b	29.40d	6.66a	7.13a	13.78a
L_6	11.61 b	10.10b	24.80a	184.98a	21.36a	206.33a	20.64f	5.39c	6.06bc	11.45c
$S\bar{x}$	0.27	0.24	0.11	2.55	0.61	2.53	0.06	0.11	0.13	0.23
LS	**	**	**	**	**	**	**	**	**	**
CV (%)	5.80	5.62	1.52	4.84	12.53	4.40	1.47	4.37	4.36	4.09

In a column, figures having common letter(s) do not differ significantly as per DMRT ; * = Significant at 5% level of probability, ** = Significant at 1% level of probability, NS = Not significant, CV = Co-efficient of variation ; L_1= ACI hybrid line 1, L_2= ACI hybrid line 2, L_3= ACI hybrid line 3, L_4= ACI hybrid line 4, L_5= ACI hybrid line 5, L_6= ACI hybrid line 6

Spacing showed significant influence on number of total tillers hill^{-1}, number of effective tillers hill^{-1}, number of grains panicle^{-1}, number of total grains pancile^{-1}, grain yield (t ha^{-1}), straw yield (t ha^{-1}), biological yield (t ha^{-1}) and harvest index (%). The highest grain yield (5.84 t ha^{-1}) was recorded from the spacing 20 cm × 20cm. The lowest grain yield (5.14 t ha^{-1}) was produced by haphazard planting. The highest number of total tillers hill^{-1} (13.19) , number of effective tillers hill^{-1} (11.85), number of grains panicle^{-1}(166.63), number of total grains pancile^{-1} (179.17), grain yield (5.84 t ha^{-1}), straw yield (6.35 t ha^{-1}), biological yield (12.19 t ha^{-1}) and harvest index (47.92%) were produced by spacing 20 cm × 20 cm as shown in Table 2.

The interaction between hybrid rice line and spacing exerted a significant influence on number of total tillers hill^{-1}, number of effective tillers hill^{-1}, panicle length (cm), 1000-grain weight (g), grain yield (t ha^{-1}), straw yield (t ha^{-1}), biological yield (t ha^{-1}) and harvest index (%).It was observed that ACI line5 produced the maximum number of tillers hill^{-1} (16.87) and maximum number effective tillers hill^{-1} (15.87) in 20 cm × 20 cm spacing. The longest panicle (25.13 cm) was found in ACI line3 with spacing 25 cm × 25 cm and the shortest one (23.51 cm) was found in ACI line1 with spacing 20 cm × 20 cm. The highest 1000-grain weight (32.24 g) was produced by ACI line4 at 25 cm × 25 cm spacing and ACI line6 produced the lowest 1000-grain weight (20.51 g) at 20 cm × 20 cm spacing. The highest grain yield (7.53 t ha^{-1}) was produced by ACI line5 at spacing 20 cm × 20 cm and the lowest grain yield (5.14lt ha^{-1}) was recorded in ACI line1 at haphazard planting. The highest straw yield (8.05 t ha^{-1}) was produced at spacing 20 cm × 20 cm by the ACI line5 and the lowest straw yield (4.75 t ha^{-1}) by the ACI line1 by haphazard planting. The results indicate that the highest biological yield (15.58 t ha^{-1}) was produced by ACI line5

at spacing 20 cm × 20 cm and the lowest grain yield (8.92 t ha^{-1}) was obtained by ACI line1 at haphazard planting. The highest number of total tillers hill^{-1} (13.90), effective tillers hill^{-1} (12.83), panicle length (24.86cm), number of grains panicle^{-1}(184.28), grain yield (6.66 t ha^{-1}), straw yield (7.13 t ha^{-1}) and biological yield (13.78 t ha^{-1}) were produced by ACI line5.

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

Spacing	No. of total tillers hill^{-1}	No. of effective tillers hill^{-1}	No. of grains panicle^{-1}	No. of total grains pancile^{-1}	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest Index (%)
S_1	11.79 b	10.63b	163.91a	175.93a	5.29b	5.86b	11.14b	47.45ab
S_2	13.19 a	11.85a	166.63a	179.17a	5.84a	6.35a	12.19a	47.92a
S_3	10.69 c	9.39c	154.80b	167.55b	5.14b	5.72b	10.86b	47.23b
$S\bar{x}$	0.16	0.14	1.85	1.81	0.06	0.06	0.11	0.17
LS	**	**	**	**	**	**	**	*
CV (%)	5.80	5.62	4.84	4.40	4.37	4.36	4.09	1.53

In a column, figures having common letter(s) do not differ significantly as per DMRT ; * = Significant at 5% level of probability, ** = Significant at 1% level of probability, NS = Not significant, CV = Co-efficient of variation; S_1=25 cm × 25 cm, S_2=20 cm × 20cm, S_3=Haphazard

Table 3. Interaction effect of hybrid line and spacing on the yield and yield components of *boro* rice

Hybrid Line × Spacing	**No. of total tillers hill^{-1}**	**No. of effective tillers hill^{-1}**	**Panicle length (cm)**	**No. of sterile spike lets panicle**	**1000 grain weight (g)**	**Grain yield (t ha^{-1})**	**Straw yield (t ha^{-1})**	**Biological yield (t ha^{-1})**
$L_1 \times S_1$	10.87f	9.87f-i	23.94ef	11.38cde	30.16c	4.63h	5.04fg	9.68gh
$L_1 \times S_2$	12.67cd	11.27cd	23.51f	11.19c-f	30.16c	4.87fgh	5.34ef	10.21fg
$L_1 \times S_3$	8.33gc	7.40k	24.53a-e	8.37fgh	30.15c	4.17i	4.75g	8.92h
$L_2 \times S_1$	13.27c	12.07c	23.70f	12.91bcd	31.66b	4.63h	5.32ef	9.96fg
$L_2 \times S_2$	15.40b	13.93b	24.03def	12.01cd	31.78b	4.93fgh	5.31ef	10.24fg
$L_2 \times S_3$	12.13cde	11.33cd	23.98ef	13.33bc	31.56b	4.77gh	5.43ef	10.20fg
$L_3 \times S_1$	11.60def	10.40d-g	25.13a	7.89gh	28.68f	5.60de	6.33bc	11.93cd
$L_3 \times S_2$	11.33ef	10.00e-h	24.98a	8.33fgh	28.54f	5.97bcd	6.38bc	12.34bc
$L_3 \times S_3$	10.33f	9.13hij	24.00ef	7.33gh	28.70f	5.93bcd	6.44bc	12.37bc
$L_4 \times S_1$	10.47f	9.40g-j	25.08a	5.69h	32.24a	5.20efg	5.63de	10.83ef
$L_4 \times S_2$	10.67f	9.13hij	24.22b-f	8.99efg	32.27a	5.80cd	6.38bc	12.18c
$L_4 \times S_3$	10.47f	8.53j	24.17c-f	10.19d-g	32.20a	5.00fgh	5.65de	10.65ef
$L_5 \times S_1$	12.33cde	11.53cd	24.96a	12.84bcd	29.71d	6.37b	6.82b	13.19b
$L_5 \times S_2$	16.87a	15.87a	24.91ab	13.73bc	29.15e	7.53a	8.05a	15.58a
$L_5 \times S_3$	12.50cde	11.10cde	24.73a-d	15.65b	29.33e	6.07bc	6.51b	12.58bc
$L_6 \times S_1$	12.20cde	10.53def	25.06a	21.41a	20.66gh	5.30ef	5.99cd	11.29de
$L_6 \times S_2$	12.23cde	10.90def	24.55a-e	21.03a	20.51h	5.97bcd	6.63b	12.60bc
$L_6 \times S_3$	10.40f	8.87ij	24.81abc	21.63a	20.77g	4.90fgh	5.57de	10.47efg
$S\bar{x}$	0.40	0.34	0.22	0.90	0.08	0.14	0.15	0.27
LS	**	**	**	*	**	**	**	**
CV(%)	5.80	5.62	1.52	12.53	1.47	4.37	4.36	4.09

In a column, figures having common letter(s) do not differ significantly as per DMRT ; * = Significant at 5% level of probability, ** = Significant at 1% level of probability, NS = Not significant, CV = Co-efficient of variation ; L_1= ACI hybrid line 1, L_2= ACI hybrid line 2, L_3= ACI hybrid line 3, L_4= ACI hybrid line 4, L_5= ACI hybrid line 5, L_6= ACI hybrid line 6; S_1=25 cm × 25 cm, S_2=20 cm × 20cm, S_3=Haphazard

The spacing (20 cm × 20 cm) produced the highest number total of tillers hill^{-1} (13.19), number of effective

tillers hill^{-1} (11.85), number of grains panicle^{-1}(166.63), grain yield (5.84 t ha^{-1}), straw yield (6.35 t ha^{-1}), biological yield (12.19 t ha^{-1}) and harvest index (47.92%).

The variation in grain yield was significant and the highest grain yield (7.53 t ha^{-1}) was produced by ACI line5 with spacing (20 cm × 20 cm) spacing.

From the results of the present experiment it may be concluded that the hybrid rice ACI line5 may be suggested for cultivation in *boro* season at spacing of 20 cm × 20 cm to obtain optimum grain yield.

References

BBS (Bangladesh Bureau of Statistics). 2006. Monthly Statistical Bulletin of Bangladesh. June 2006.Stat. Div. Ministry Planning, Govt. People's Repub. Bangladesh. Dhaka.p 47

Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. 2nd Edn. John Willey and Sons. New York. p 68.

Miah M. H. N., Karim M. A.and Rahman M. S. 1990 Performance of Nizershail Mutants under different spacing. Bangladesh J. Train. and Dev. 3(2): 31-34.

Rafiq K., Maqsood M., Akbar N. and Iqbal M.S. 1998. Effect of different special arrangement on yield and yield components of fine rice (Basmati-385). Pakistan J. Agril. Sci. 35 (1-5): 59-61.

UNDP and FAO (United Nations Development Programme and Food and Agricultural organization). 1988. Land Resources Appriasal of Bangladesh for Agricultural Development Rep. 2. Agroecological Regions of Bangladesh. BARC/UNDP, New Air Port Rode, Farmgate, Dhaka-1207. pp. 212-221.