ISSN 0258-7122
Bangladesh J. Agril. Res. 34(1) : 33-39, March 2009

VARIETAL PERFORMANCE OF TRANSPLANT AMAN RICE UNDER DIFFERNT HILL DENSITIES

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Abstract

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh from July to December 2004 to evaluate the effect of hill spacing on the performance of BRRI dhan40 and BRRI dhan41 as Transplant aman crop. The experiment consisted of five hill spacings viz., 5cm. 10cm, 15 cm, and 25 cm where row to row spacing of 25 cm was kept constant for all treatments. The experiment was laid out in randomized complete block design with four replications. The 25 cm x 5 cm hill spacing produced the tallest plant, highest total number of tillers/hill, bearing tillers/hill lowest number of non-hearing tillers/hill, grain yield and harvest index, while 25 cm x 5 cm hill spacing produced the highest number of sterile spikelets/panicle, straw yield and biological yield. BRRI dhan41 produced higher grain yield (4.7 t/ha) which was the contribution of higher number of grains/panicle and heavier grain weight. Lower yield (4.51 t/ha) was recorded in BRRI dhan40.

Key Words: Varietal performance, *T. aman* rice, hill density.

Introduction

In Bangladesh, about 10.77 million hectares of land is under rice cultivation producing 25.18 million metric tons of rice but the average yield of this crop is only 2.33 t/ha (BBS, 2003). The horizontal expansion of rice area in the country is not possible because of conversion of arable land into non-arable land due to population pressure. So, the normal way is to increase the yield of this crop through management practices. Optimum hill spacing ensures the proper growth of aerial and underground plant parts utilizing more solar radiation and nutrients (Miah *et al.,* 1990). The competition among plants for light, water, and nutrients become severe, when hill spacing exceeds the optimum level. Consequently, the plant growth slows down and ultimately the grain yield decreases. The tillering habit and production of spikelets/panicle depends on the spacing of transplanting to a great extent, which is responsible for the variation of yield in rice unit area. BRRI dhan40 and IIRRI dhan41, the newly released T. *ainan* rice varieties by the Bangladesh Rice Research Institute and further studies are needed in respect of their agronomic practices, especially to determine the optimum hill spacing as transplant aman crop. Therefore, the present study was undertaken to find out the

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optimum hill spacing of two transplant aman rice cv. BARI Dhan40 and BRRI dlian41 and also to observe the effect of interaction between hill spacing and variety in order to improve their yield and yield components.

Materials and Method

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from July to December 2004 to study the effect of hill spacing on the yield and yield contributing characters of T. *aman* rice.The experimental field was silty loam in texture with a pH value of 6.4. The experiment was laid out in a randomized complete block design with four replications. Two varieties viz., BRRI dhen40 and BRRI dhan41 and five hill spacings viz., 5 cm, 10 cm, 15 cm, 20cm, and 25 cm where the row spacing of 25 cm was kept constant for all treatments were included in the study. The unit plot size vas 4.0 m × 2.5 m. At the time of final land preparation, each unit plot was fertilized with urea, triple super phosphate, muriate of potash. gypsum, and zinc sulphate to provide N, P, K, S, and Zn at the rate of 132.5, 51.25, 60, 33.75, and 5 kg/ha. respectively. Urea was top-dressed in three equal splits at 15, 30, and 45 days after transplanting. Thirty-day old seedlings were transplanted at the rate of two seedlings/hill on 2 August 2004. Cultural operations were done as and when necessary. The crop was harvested on 10 December 2004. The plants of outer row and the extreme ends of the middle rows were excluded to avoid border effect. Five hills were randomly selected from each unit plot prior to harvest for recording data on plant height, total tillers/hill, bearing tillers/hill, non-baring tillers/hill, panicle length, grains/paicle, sterile spikelets/panicle, and 1000-grain weight. Grain yield, straw yield, and harvest index were recorded at harvest. The grains were cleaned and finally the weight was adjusted to a moisture content of 14%. The straws were sun dried and the yield of grain and straw/plot were converted to t/ha. Collected data were analyzed statistically floolwing ANOVA technique and the mean differences were adjudged by Duncan's multiple Range lest (Gomez and Gomez, 1984).

Results and Discussion

Effect of variety

The result indicated that all the yield and yield contributing character differed significantly due to varietal difference (Table 1). BRRI dhan41 produced significantly higher tillers/hill, bearing tillers/hill, grains/panicle, sterile spikelets/pancicle and the ultimate grain yield. The rice variety BRRI dhan41 produced statistically higher number of total tillers/hill (7.87) than that of BRRI dhan40, which is in conformity with the results of Chowdhury *et al.* (1993). Significantly higher number of bearing tillers/hill (5.56) was recorded from BARI dhan41 than BRRI dhan40. The response of difference in producing

Table 1. Yield and yield attributes of modern varieties T. *aman* rice as influenced by the hill spacing.

Treatments	Plant height (cm)	Total tillers/ hill (no.)	Non-bearing tillers/hill	Bearing length (cm)	Panicle length (cm)	Grains/ panincle (no.)	Sterile grains/ panicle (no.)	100-grain wt (g)	Grain yield (t/ha)	Straw yield (t/ha)	Biological yield (t/ha)	Harvest Index (HI %)
Variety: 2												
BRRI *dhan40*	126.41	7.15 b	2.10	5.05ab	24.74	168.0b	22.5a	25.35	4.5ab	11.72ab	7.24	38.56
BRRI dhan41	121.63	7.87a	2.31	5.56a	24.29	175.0a	21.70b	25.70	7.47a	11.75a	7.06	40.01
CV (%)	6.24	7.43	22.55	11.30	4.52	4.12	5.12	9.19	6.58	3.73	7.57	7.18
Level of singificance	ns	**	ns	**	ns	**	*	ns	*	*	ns	ns
Spacing (cm):5												
25 × 5	117.7c	5.0d	2.05bc	2.98c	23.7vc	139.2d	27.0a	24.0	3.9c	8.31a	12.21a	32.15c
25 × 10	122.1bc	6.3c	2.01bc	4.27b	25.8a	157.2c	25.2b	26.5	4.4b	7.78a	12.18ab	36.14b
25 × 15	128.3ab	7.6b	1.84c	5.81b	24.9ab	175.6b	22.4c	25.0	4.5b	7.19b	11.74bc	38.76b
25 × 20	131.9a	9.5a	2.65a	6.89a	24.7ab	194.9a	17.0e	25.4	5.1a	6.35c	11.40cd	44.27a
25 × 25	119.9c	9.0a	2.48ab	6.57a	23.4c	190.6a	19.0d	26.7	5.0a	6.11c	11.14d	45.11a
CV (%)	6.27	7.43	22.55	11.30	4.52	4.12	54.12	9.19	6.58	7.57	3.73	7.18
Level of significance	**	**	**	**	**	**	**	ns	**	**	**	**

In a column, means having similar letter(s) or without letter(s) do not differ significantly as per DMRT.

NS= Not significant, **means 0.01% level of significance, *means 0.05% level of significance.

hearing tillers/hill might be due to the variation in genetic make up of the variety. BRRI dhan41 also produced significantly higher number of grains/panicle (175.0) than BRRI dhan40. Hossain and Alam (1991) reported that the number of grains/panicle was influenced significantly due to variety. It was evident from the results that BRRI dhan41 yielded higher grain (4.7 t/ha) than that of BRRI dhan40 (4.5 t/ha). The probable reasons might he due to fine longest grain size of BRRI dhan41. This result is in agreement with the findings of Ahmed (1987) and Alam (1988). Hence, these variations in yield might be due to genetic make up of the varieties. Both the varieties showed non-significant variation on plant height. non-bearing tillers/hill, panicle length, 1000-grain weight, biological yield and harvest index. However, the significantly lower straw yield (11.72 t/ha) was recorded in BRRI dhan40.

Effect of spacing

All the yield attributes except 1000-grain weight varied significantly due to different hill spacings (Table 1). The 25 cm x 20 cm hill spacing produced the tallest plant (131.9 cm), which was identical to 25 cm x 15 cm hill spacing. The 25 cm x 15 cm hill spacing produced the shortest plant (117.7 cm). This is in agreement with the findings of Shirakawa *et al.* (1992). The highest total number of tillers/hill (9.5) was recorded from 25 cm x 20 cm hill spacing which showed similarity with the results reported by Shah *et al.* (1991) The highest number of bearing tillers/hill (6.89) was obtained in 25 cm x 20 cm hill spacing and the lowest one (2.98) was recorded in 25 cm x 5 cm hill spacing. The different responses for hill spacing might be due to that the wider spacing allowed more light, space and for producing higher number of bearing/tillers. These results are in agreement with the findings of Akita and Tanaka (1992). In case of non-bearing tillers/hill 25 cm × 20 cm hill spacing produced the highest number (2.65) whereas, the lowest number (1.84) was found in 15 cm hill spacing. The longest panicle (25.8 cm) was produced by 25 cm x 10 cm hill spacing and the shortest one (23.4 cm) was found in 25 cm x 25 cm hill spacing (Table 1) Competition among the plants for space, air, water, light, and nutrients in the dense transplanted crop might have resulted in small panicle size. The result is in agreement with findings of Liou (1987). The plant stand under 25 cm x 20 cm hill spacing produced the highest number of grains/panicle (194.9), which was statistically identical with 25 cm x 25 cm hill spacing and the lowest one (139.2) was produced by 25 cm x 5 cm hill spacing. This observation is in agreement with that of Rao *et al.* (1990). The reason might he the fact that from wide spacing plant got more nutrient and moisture which eventually led to development of more grains comparing to closer spacing. This result is also consistent with that of Ghosh *et al.* (1988).

Fable 2. Interaction effect of variety and hill spacing on ield and yield contributing characters of Transplant aman rice.

Interaction (Variety × hill spacing)		Plant height (cm)	Total tillers/ hill (no.)	Bearing tillers/ hill (no.)	Non-bearing tillers/ hill (no.)	Panicle length (cm)	Grains/ panicle (no.)	Sterile spikelets/ panicle (no.)	1000-grain wt (g)	Grain yield (t/ha)	Straw yield (t/ha)	Biological yield (t/ha)	Harvest Index (HI %)
BRRI *dhan40*	25cm×5cm	111.52b	4.16e	2.65	1.52c	23.81bc	136.25	27.50	23.50	3.80	8.53	12.33	31.27
	25cm×10cm	132.75a	6.08d	4.32	1.796bc	27.83a	150.00	25.00	26.00	4.35	7.85	12.20	35.65
	25cm×15cm	132.96a	7.62c	5.48	2.14abc	24.58bc	171.50	23.25	26.00	4.40	7.33	11.73	37.52
	25cm×20cm	132.99a	9.00b	6.19	2.81a	24.24bc	19.25	17.50	26.25	4.90	6.35	11.25	43.53
	25cm×25cm	130.85a	8.89b	6.61	2.29abc	23.22c	190.00	19.50	25.00	4.98	6.35	11.25	43.53
BRRI *dhan41*	25cm×5cm	123.96a	5.88d	3.30	2.58a	23.65bc	142.25	26.50	24.50	4.00	8.10	12.10	33.063
	25cm×10cm	111.52a	6.48d	4.22	2.26abc	23.80bc	164.50	25.50	27.00	4.45	7.70	12.15	365.63
	25cm×15cm	132.75a	7.68c	6.14	1.54c	25.18b	179.75	21.50	24.00	4.70	7.05	11.75	40.00
	25cm×20cm	130.85a	10.09a	7.59	2.50ab	25.18b	197.50	16.50	2.50	58.20	6.35	11.55	454.01
	25cm×25cm	109.06b	9.22b	6.54	2.687a	23.65bc	191.25	18.50	28.50	5.08	6.10	11.18	45.41
CV (%)		6.27	7.43	11.30	22.55	4.52	4.12	5.12	9.19	6.58	7.57	3.73	7.18
Level of significance	**	**	ns	**	**	ns	ns	ns	ns	ns	ns	ns	ns

In a colomn, means having similar letter(s) or without letter(s) do not differ significantly as per DMRT.

NS= Not significant, **means 0.01% level of significance, *means 0.05% level os significance.

The plant stand under 25 cm x 5 cm hill spacing produced the highest number of sterile spikelets/panicle (27.0) and the lowest one (17.0) was produced in 25 cm x 20 cm hill spacing. A gradual trend to increase sterile spikelets/ panicle was observed with decreased spacing. It might be due to supply of insufficient food materials, moisture and light for plant in closer spacing. It is evident that the highest grain yield (5.1 t/ha) was obtained from 25 cm x 20 cm hill spacing, which was identically followed by 25 cm x 25 cm hill spacing and the lowest grain yield (3.9 t/ha) was obtained from 25 cm x 5 cm hill. The result shows 25 cm x 5 cm hill spacing produced the highest straw yield (8.31 t/ha) and the lowest straw yield (6.11 t/ha) was found in 25 cm x 25 cm hill spacing, which was identical to 25 cm x 20 cm hills spacing. From the observation, it was found that straw yield decreased with the wider spacing. Similar results were reported by Islam *et al.* (1994) and Son (1989). The highest biological yield (12.21 t/ha) was produced in 25 cm x 10 cm hill spacing and the lowest one (11.14 t/ha) in 25 cm x 25 cm hill spacing. It was observed that biological yield increased with decreased plant spacing. The highest harvest index (45.11%) was recorded in 25 cm x 25 cm hill spacing, which was identical to 25 cm x 20 cm hill spacing and the lowest harvest index (32.15%) was observed in 25 cm x 5 cm hill spacing which might have occurred due to the lower grain yield and the highest plant population existing in closer spacing

Effect of interaction of hill spacing and variety

The results presented in the Table 2 exhibited that there were significant influences in terms of plant height, total tillers/hill**,** non-hearing tillers/hill and panicle length due to interaction effect of variety and hill spacing. The tallest plant (132.99 cm) was obtained from the interaction of BRRI dhan40 × 20 cm hill spacing and the shortest plant (109.06 cm) was found in the interaction of BRRI dhan41 × 25 cm hill spacing. The highest number of total tillers/hill (10.09) was obtained in the interaction of BRRI dhan41 × 20 cm hill spacing and the lowest one (4.16) was found in interaction of BRRI dhan40 × 5 cm hill spacing. The interaction of BRRI dhan40 × 20 cm hill spacing produced the highest non-bearing tillers/hill (1.52) as observed in BRRI dhan40 × 5 cm hill spacing. The longest panicle length (27.83 cm) was produced in BRRI dhan40 with 10 cm hill spacing and the shortest one (23.33 cm) was produced in BRRI dhan40 with 25cm hill spacing. From the above results, it may be concluded that 25 cm × 20 cm spacing in respect of grain yield appeared as the best management practice for the cultivation of cv. BRRI dhan41 as T. *aman* crop for getting maximum yield.

References

Ahmed, M.R. 1987. Green manuring and nitrogen rate on *boro* yield. M.Sc. (Ag). Thesis. Dept. of Agron., BAU, Mymensingh. pp. 23-39.

Akita, K. and N. Tanaka. 1992. Effect of planting density and planting patterns of young seedlings transplanting on the growth and yield of rice plants. *Japan. J. Crops Sci.* **61**(1): 80-86.

Alam, A.B.B.M. 1988. Performance of local and modern varieties of *boro* rice under irrigated condition. In: Research Activities 1986-87, Naogaon Site. Farming Systems Research and Development, BAU, Mymensingh, pp. 7-10.

BBS (Bangladesh Bureau of Statistics). 2003. Statistical Year Book, Stat. Divn, Ministry. of Plan., Govt. People's Repub. Bangladesh. Dhaka. pp. 123-127.

Chowdhury, M.J.U., A.U. Sarkar, M.A.R. Sarkar, M.A. Kashem. 1993. Effect of variety and number of seedlings per hill on the yield and its components of late transplanted *aman* rice. *Bangladesh J. Agril. Sci.* **20**(2): 311-316.

Ghosh, B.C., M.A. Reddy, and B.B. Reddy. 1988. Effect of seedling density on growth and yield of transplanted rice. Central Rice Res. Inst., Cuttack, Orssa, India. **21**(1): 13-21.

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

Hossain, S.M.A. and Alam, A.B.M.M. 1991. Productivity of cropping patterns of participating farmer. In: Fact Serching and Intervention in two FSRD sites. Activities 1980-90. Farming Systems Research and Development. BAU, Mymensingh. pp. 41-44.

Islam, M.S., M.A.R. Sarkar, M.S. Rahman, A.M. Musa, and S.C. Dham. 1994. Effect of cultivar and NPK combination on the yield contributing characters of rice. *Bangladesh J. Agril. Sci.* **15**(1): 105-110.

Liou, T.M. 1987. Effect of spacing and fertilizer levels on changes of ear type in rice. J. *Agric. Assoc. China.* **140:** 1-10

Miah, M.H.N., M.A. Karim, M.S. Rahman, and M.S. Islam. 1990. Performance of Nizersail mutants under different row spacings. *Bangladesh J. Train. Dev.* **3**(2): 31-34.

Rao, K.S., B.T.S. Moorhy, and G.B. Manna. 1990. Plant population for higher productivity in Basmati type scented rice. *Int. Rice. Res. Notes* (IRRN), **15**(1): 25.

Shah, M.H., M.K. Khusu, B.A. Khandays, and A.S. Bali. 1991. Effect of spacing and seedlings per hill on transplanted rice under late sown condition. *Indian J. Agron.* **36**(2): 274-275.

Shirakawa, N., H. Tomioka, and M. Fukuzawa. 1992. The relationship between planting density and the function of the plant growth regulator, *inbenafide. Agric and Hort.* **67**(5): 609-611.

Son, Y., S.T. Park, S.C. Kim, and S.S. Lee. 1988. Varietal response on different planting densities in rice. Rep. Rural Dev. *Admin. Rec. Korea.* **31**(4): 1-6.