Varietal Performance And Effect Of Planting Method On Yield And Yield Contributing Characteristics Of Rice

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Abstract: The experiment was carried out to study the performance of two aman rice varieties (BRRI dhan31 and BRRI dhan41) under different planting methods (line sowing with sprouted seeds by drum seeder, haphazard transplanting and transplanting in line). Both the variety and planting method had significant effect on crop characters plant height, number of total tillers m-2, effective tillers m-2, grains panicle-1, sterile spikelets panicle-1, total spikelets panicle-1, grain yield except panicle length and 1000-grain weight. BRRI dhan41 produced the highest grain yield (4.06 t ha-1). Line sowing method with sprouted seeds by drum seeder showed better performance in respect of no. total tillers m-2 (415.81), effective tillers m-2 (401.85) and grain yield (4.80 t ha-1). The highest no. of total tillers m-2 (421.12), effective tillers m-2 (410.65) and grain yield (5.08 t ha-1) were recorded due to effect of the interaction of line sowing method with sprouted seeds by drum seeder and the variety BRRI dhan41.

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1. Introduction

In Bangladesh Agriculture, rice is the most dominant crop due to its uneven topography and humid climate along with abundant monsoon rain. The area and the production of rice in our country are 11.25 million hectares and 29.75 million tons respectively (AIS, 2007).

Food deficit has been increasing in Bangladesh at an alarming rate due to increase in population growth and low yield of food crops achieved per unit area. On the other hand, agricultural land is decreasing day by day. About 220 hectares agricultural lands are decreased per year due to urbanization, industrialization, housing and road construction purposes. Fifty lakh acres of agricultural land decreased during last 20 years (Annon, 2007). So we have to think how to solve the food problem of the country. Since there is little scope of horizontal expansion of the rice area in the country; attempt should be made to increase the yield per unit area.

Variety itself is a genetic factor which contributes much in producing yield and yield components of a particular crop. Yield components are directly related to a variety and its environment in which it grows (Roy et al, 2014). The high yielding varieties have higher yield potentiality compared to the existing local varieties. Bangladesh Rice Research Institute (BRRI) has released 45 modern varieties of rice suitable for cultivation in different regions and seasons of Bangladesh of which BRRI dhan31, BRRI dhan32, BRRI dhan40 and BRRI dhan41 are suitable for cultivation in the aman season. Higher yield could be achieved from these varieties if appropriate method of planting is used for cultivation of these rice varieties.

There are three major methods of rice cultivation, namely transplanting, wet seeding and dry seeding (Pandey, 1994). Wet seeding by Drum Seeder not only saves the time but also saves the cost of production, as the crop does not suffer from transplanting shock and does not require labour cost for uprooting and transplanting seedlings in the main field. Sattar and Khan (1995) reported that direct seeding of rice requires less labour involvement and less water use compared with transplanted rice. Direct wet seeding via hand broadcasting has been found to give 10-15 percent increased yield. Direct seeded crop also mature 10-20 days earlier than transplanted rice. Direct wet seeded rice using drum seeder has out yielded the conventional transplanted rice by 15-20 percent both in (July-November) and (November-May) seasons (Husain, 2005).

2. Material and Methods

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University (BAU), Mymensingh during the period from August to December 2011 to study the effect of variety and planting method on the yield and yield components of Aman rice. Two varieties BRRI dhan31 and BRRI dhan41 and three planting methods i.e. line sowing with sprouted seeds by drum seeder, haphazard transplanting and line transplanting were used. The experiment was laid out in split-plot

design with four replications. Treatment combinations were assigned at random in block. Total number of unit plots were 2 x 3 x 4 = 24 and each plot size was 4.0 m x 2.5 m. The distance maintained between the main plot and the replications were 0.5 and 1.0 m, respectively. The experimental plots were fertilized with urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate @ 220, 120, 80, 60, 10 kg ha-1 respectively. Intercultural operations and proper management practices were done. The yield contributing characters viz. plant height, total number of tillers m-2, effective tillers m-2, non effective tillers m-2, panicle length, grains panicle-1, sterile spikelets panicle-1, total number of spikelets panicle-1, thousand grain weight, grain yield, straw yield, biological yield and harvest index were measured. The analysis of variance was done with the help of computer package program MSTAT-C and the mean differences were adjudged by Duncan's New Multiple Range Test (Gomez and Gomez, 1984).

3. Results and discussion

Results obtained from the present study regarding the influence of variety and planting method and their interaction on different crop characters of Aman rice are presented and discussed below.

In the effect of variety, the tallest plant (115.29 cm) was obtained in BRRI dhan41 whereas the shortest one (106.14 cm) of BRRI dhan31 (Table 1). In planting method, the tallest plant (112.52 cm) was found from line sowing method with sprouted seeds by drum seeder which was statistically (111.35 cm) identical to transplanting in line and the shortest one (108.28 cm) from haphazard transplanting (Table 2). The interaction effect of variety and planting method, numerically the tallest plant (117.31 cm) was found in BRRI dhan41 under line sowing method with sprouted seeds by drum seeder and the shortest one (103.22 cm) in BRRI dhan31 under transplanted method in line (Table 3).

The variety BRRI dhan41 produced the highest total tillers m-2 (411.78) and BRRI dhan31 produced the lowest one (393.19). In planting method, line sowing with sprouted seeds by drum seeder method produced the highest (415.81) total tillers m-2 and the lowest tillers m-2 (388.62) was in haphazard transplanting method (Table 2). The interaction effect of variety and planting method, the highest total tillers m-2 (421.12) was found in BRRI dhan41 under line sowing with sprouted seeds by drum seeder and the lowest total tillers m-2 (378.12) was found in BRRI dhan31 under haphazard transplanting (Fig. 1).

The highest effective tillers m-2 (377.35) was observed in BRRI dhan41 and the lowest one (363.02) in BRRI dhan31 (Table 1). In planting method, the highest effective tillers m-2 (401.85) was obtained from line sowing with sprouted seeds by drum seeder and the lowest one (348.87) was found in haphazard transplanting method. The interaction effect of variety and planting method, the highest effective tillers m-2 (410.65) was observed in BRRI dhan41 under line sowing with sprouted seeds by drum seeder and the lowest one (342.97) was observed in BRRI dhan31 haphazard transplanting method (Fig. 2).

Numerically the highest non-effective tillers m-2 (34.43) was found in BRRI dhan41 and the lowest one (30.17) was observed in BRRI dhan31 (Table 1). In planting method, the highest non-effective tillers m-2 (43.19) was observed under transplanting in line method which was statistically identical (39.75) with haphazard transplanting method and the lowest non-effective tillers (13.96) m-2 was found in line sowing with sprouted seeds by drum seeder (Table 2). The interaction effect of variety and planting method, the highest non-effective tillers m-2 (48.48) was found in BRRI dhan41 under transplanting in line method which was statistically alike with BRRI dhan41 under haphazard transplanting method. The lowest non-effective tillers m-2 (10.47) was observed in BRRI dhan41 under line sowing with sprouted seeds by drum seeder method (Table 3).

The longest panicle (23.72 cm) was obtained form BRRI dhan41 and the shortest one (23.53 cm) was from BRRI dhan31 in the variety effect (Table 1). Transplanting in line method produced numerically the longest panicle (24.15 cm) and intermediate (24.10) from line sowing with sprouted seeds by drum seeder method and the lowest (22.63) from under haphazard transplanting method. Transplanted rice utilized the nutrients and solar radiation more efficiently which might be the reason for longer panicle in transplanted rice. These findings are in agreement with the findings of Gupta et al. (1976), Bhuyan et al. (2012). The interaction of variety and planting method, the longest panicle (24.80 cm) was found in BRRI dhan41 under line sowing with sprouted seeds by drum seeder method and the shortest one (21.96 cm) was observed in BRRI dhan31 under haphazard transplanting (Table 3).

In the variety effect, the highest grains panicle-1 (109.38) was observed in BRRI dhan41 and the lowest one (99.96) in BRRI dhan31 (Table 1). In planting method, the highest grains (112.20) was found in line sowing with sprouted seeds by drum seeder and the lowest one (98.04) observed in haphazard transplanting (Table 2). Grains m-2 in direct seeding of sprouted seeds in puddle soils using drum seeder is higher than the transplanted rice

which might be the reason for less number of grains panicle 1. These findings are in agreement with the findings of Husain (2005). The interaction effect of variety and planting method, the highest grains panicle-1 (122.70) was observed in BRRI dhan41 in line sowing with sprouted seeds by drum seeder method and the lowest grains panicle-1 (97.01) was observed in BRRI dhan31 under haphazard transplanting (Table 3).

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

Variety	Plant height (cm)	No. of total tillers m^{-2}	No. of effective tillers m^{-2}	No. of non-effective tillers m^{-2}	Panicle length (cm)	No. of grains $panicle^{-1}$	No. of sterile spikelets $panicle^{-1}$	No. of total spikelets $panicle^{-1}$	1000-grain weight	Grain yield ($t\ ha^{-1}$)	Straw yield ($t\ ha^{-1}$)	Biological yield ($t\ ha^{-1}$)	Harvest index (%)
V_1	106.14*	393.19b	363.02b	30.17	23.53	99.96b	48.67a	148.63b	23.36	3.60b	5.44	9.04	39.59
V_2	115.29a	411.78a	377.35a	34.43	23.72	109.38a	45.21b	154.58a	23.03	4.06a	5.25	9.31	43.38
$S\overline{X}$	0.35	1.06	1.82	2.61	0.54	0.32	0.02	0.32	0.08	0.03	0.24	0.27	0.86
Level of significance	**0.01**	**0.01**	**0.05**	**NS**	**NS**	**0.01**	**0.01**	**0.01**	**NS**	**0.01**	**NS**	**NS**	**NS**

* In a column figures with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT).V1 = BRRI dhan31, V2 = BRRI dhan41, and NS = Not significant.

Table 2. Effect of different planting methods on yield and yield contributing characters of transplant Aman rice

Planting method	Plant height (cm)	No. of total tillers m^{-2}	No. of effective tillers m^{-2}	No. of non-effective tillers m^{-2}	Panicle length (cm)	No. of grains $panicle^{-1}$	No. of sterile spikelets $panicle^{-1}$	No. of total spikelets $panicle^{-1}$	1000-grain weight	Grain yield ($t\ ha^{-1}$)	Straw yield ($t\ ha^{-1}$)	Biological yield ($t\ ha^{-1}$)	Harvest index (%)
M_1	112.52a*	415.81a	401.85a	13.96b	24.1	112.20a	38.08c	150.27b	23.12	4.80a	5.69	10.49a	45.78a
M_2	108.28b	388.62c	348.87c	39.75a	22.63	98.04c	58.19a	156.23a	22.93	3.08b	5.17	8.25b	37.49b
M_3	111.35a	403.02b	359.83b	43.19a	24.15	103.76b	44.55b	148.32b	23.55	3.62b	5.18	8.80b	41.18b
$S\overline{X}$	0.7	0.84	2.08	2.26	0.52	0.63	0.81	1.18	0.43	0.04	0.19	0.19	0.95
Level of significance	**0.05**	**0.01**	**0.01**	**0.01**	**NS**	**0.01**	**0.05**	**0.01**	**NS**	**0.01**	**NS**	**0.01**	**0.01**

* In a column figures with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT). M_1 = Line sowing with sprouted seeds by drum seeder, M_2 = Haphazard transplanting, M_3 = Transplanted in line, NS = Not significant

Table 3. Effect of interaction (variety and different planting methods) on yield and yield contributing characters of transplant *Aman* rice

Variety × Spacing	Plant height (cm)	No. of non-effective tillers m^{-2}	Panicle length (cm)	No. of grains $panicle^{-1}$	No. of sterile spikelets $panicle^{-1}$	No. of total spikelets $panicle^{-1}$	1000- grain weight	Straw yield ($t\ ha^{-1}$)
V1M1	107.73b	17.45c	23.83	101.69cd	40.21cd	141.90d	23.33	5.68
V1M2	103.22c	35.15b	21.96	97.01d	58.54a	155.55abc	23.03	5.42
V1M3	107.48b	37.90b	24.80	101.16c	47.28b	148.44c	23.73	5.23
V2M1	117.31a	10.47c	24.37	122.7a	35.94d	158.64a	22.91	5.70
V2M2	113.33a	44.35ab	23.30	99.07d	57.85a	156.92ab	22.83	4.92
V2M3	115.23a	48.48a	23.49	106.37b	41.82c	148.19bc	23.36	5.14
$S\overline{X}$	0.99	3.2	0.73	0.89	1.15	1.67	0.6	0.26
Level of significance	*	**0.05**	**NS**	**0.01**	**0.05**	**0.01**	**NS**	**NS**

In a column figures with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT).
V1 = BRRI dhan31, V2 = BRRI dhan41, NS = Not significant
M_1 = Line sowing with sprouted seeds by drum seeder, M_2 = Haphazard transplanting, M_3 = Transplanted in line

BRRI dhan31 produced the highest number of sterile spikelets panicle-1 (48.67) and BRRI dhan41 produced the lowest one (45.21) in the variety effect (Table 1). In planting method, the highest number of sterile spikelets panicle-1 (58.19) was obtained from under haphazard transplanting method and the lowest one (38.08) from line sowing with sprouted seeds by drum seeder method (Table 2). The interaction effect of variety and planting method, the highest sterile spikelets panicle-1 (58.54) was observed in BRRI dhan31 under haphazard transplanting method which was statistically identical to BRRI dhan41 and haphazard transplanting method and lowest one (35.94) in BRRI dhan41 under line sowing with sprouted seeds by drum seeder method (Table 3).

BRRI dhan41 produced the highest total spikelets (154.58) panicle-1 and BRRI dhan31 produced the lowest total spikelets (148.63) panicle-1 (Table1). The highest total spikelets panicle-1 (156.23) was obtained from haphazard transplanting method and the lowest one (148.32) from transplanting in method which was statistically similar with (150.27) (Table 2). The interaction effect of variety and planting method, the highest total spikelets panicle-1 (158.64) obtained from BRRI dhan41 under line sowing with sprouted seeds by drum seeder method which was statistically similar with BRRI dhan41 under haphazard transplanting method and the lowest one (141.90) from BRRI

dhan31 and under line sowing with sprouted seeds by drum seeder method (Table 3).

Numerically the highest 1000-grain weight (23.36 g) was obtained from BRRI dhan31 and the lowest one (23.03 g) from BRRI dhan41 (Table 1). In the interaction effect of variety and planting method, the higher 1000-grain weight (23.73g) was obtained form BRRI dhan31 under line sowing with sprouted seeds by drum seeder method and lower (22.83g) form BRRI dhan31 under line sowing with sprouted seeds by drum seeder method (Table 3).

BRRI dhan41 produced the highest grain yield (4.06 t ha-1) and BRRI dhan31 produced the lowest grain yield (3.60 t ha-1) (Table 1). The highest grain yield (4.80 t ha-1) was found in line sowing with sprouted seeds by drum seeder method and the lowest one (3.08 t ha-1) in haphazard transplanting method which was statistically identical (3.62) with transplanting in method (Table 2). The highest grain yield(5.05 tha-1) was obtained from BRRI dhan41 under line sowing with sprouted seeds by drum seeder method and the lowest one (3.20 t ha-1) from BRRI dhan41 under haphazard transplanting method which was statistically similar (3.35) to BRRI dhan31 and transplanting in planting method (Fig. 3). This result is suggested by Naresh et al. (2013); Laary et al. (2012); Rana et al. (2014); Oyewole et al. (2010).

Numerically observed that the highest straw yield (5.44 t ha-1) was obtained from BRRI dhan31 and the lowest one (5.25 t ha-1) from BRRI dhan41 (Table 1). The highest straw yield (5.69 t ha-1) was found in line sowing with sprouted seeds by drum seeder method and the lowest one (5.17 t ha-1) in haphazard transplanting method (Table 2).

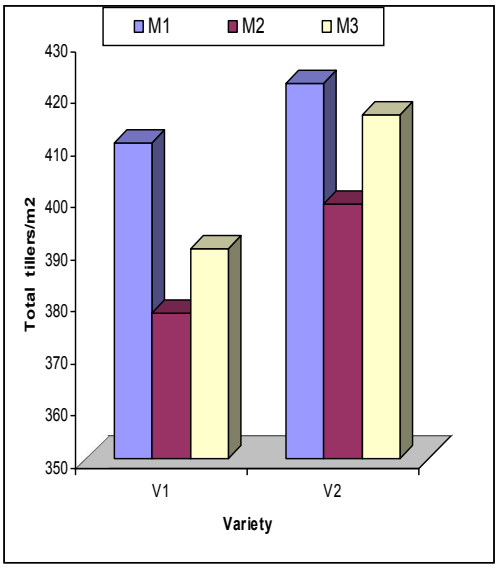

Fig. 1 Effect of variety and planting method on the number of total tillers m^{-2} of transplant *aman* rice

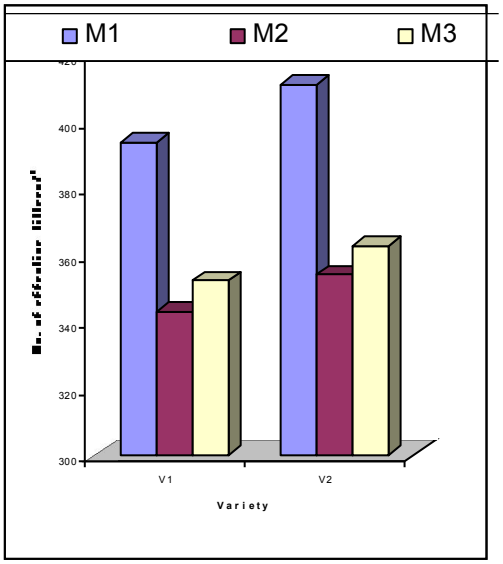

Fig. 1 Effect of variety and planting method on the number of effective tillers m^{-2} of transplant *aman* rice.

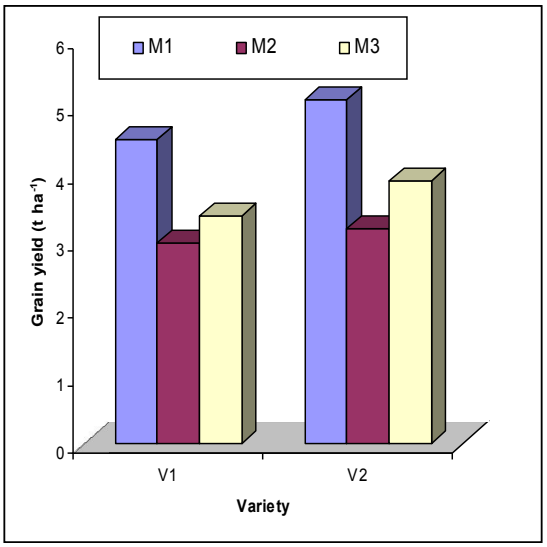

Fig. 3 Effect of variety and planting method on grain yield (t ha^{-1}) of transplant *aman* rice

V_1 = BRRI dhan31, V_2 = BRRI dhan41

M_1 = Line sowing with sprouted seeds by drum seeder

M_2 = Haphazard transplanting, M_3 = Transplanted in line

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