Growth and yield performance of *T. aman* rice varieties under different date of transplanting in southern region

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Abstract: A field experiment was conducted at the Research Farm of the Patuakhali Science and Technology University, Dumki, Patuakhali during the period from July to December 2013 to study on the performance of selected *T. aman* rice varieties as influenced by different transplanting date. Two HYV *T. aman* rice namely BRRI dhan46 and BINA dhan7 and four transplanting date *viz.*12 July, 27 July, 12 August and 27 August were used and the experiment was laid out in two factor RCBD with three replications. BRRI dhan46 at 12 July transplantation showed significantly better performance than BINA dhan7. In case of Transplantion at 12 July, BINA dhan7 produced more leaves (63.10 plant^{-1}), higher LAI (3.294) but similar transplantion at 12 July, BRRI dhan46 showed greater results on plant height (95.27 cm), no. of total tillers hill^{-1} (17.97), no. of effective tillers hill^{-1} (15.63), no. of non–effective tillers hill^{-1} (0.833), no. of total and effective grains panicle^{-1} (148.0 and 139.40), 1000–grain weight (27.14 g), yield of grain, straw and biological (4.650, 6.187 and 10.84 t ha^{-1}). From the above results, it could be found that the early transplanting of 12 July was the most advantageous transplanting date among four transplanting dates and the variety BRRI dhan46 was the most productive variety than BINA dhan7 for obtaining the greater production of rice under the Southern region.

Key words: *T. aman* rice, transplanting date, growth, yield.

Introduction

In Bangladesh, rice covered an area of 28.5 thousand acres with a production of 33.5 million metric tons while the average yield of rice is around 1.2 thousand tons per acres. But a steady growth in agriculture as well as in food production, Bangladesh has been facing persistent challenges in achieving food security. This is mainly due to natural disasters and fluctuations in food prices. So, the 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. Use of local cultivars is one of the most important reasons for low yield. However, the potential for increasing rice production strongly depends on various factors like as cultivar, fertilizer application, planting methods, sowing time, seed rate etc. Among them, selection of a better cultivar concerning the regional condition of the cultivated area is the most important features for maximizing the rice yield.

Use of high yielding cultivar (HYV) has been increased remarkably in recent years and the country has almost reached a level of self sufficiency in food. Transplanting date is another most important factor for rice cultivation. Transplanting rice in the optimum period of time is critical to achieve high grain yield. However, optimum rice planting dates are regional and vary with location and genotypes. The date of transplanting is the appropriate time for important properties such as maximum tillering, number of tillers, plant height, grain weight and grain yield. The late transplanting, shortened the growth period of the plant which reduced the leaf area, length of panicle and number of grains per panicle. So, time of planting is the most important factor in influencing the yield of the crop. Keeping in view the above facts, this research was undertaken to find out the most suitable date of transplanting concerning various growth characters and yield traits and also to compare the growth and yield performance of the selected BRRI dhan46 and BINA dhan7 variety under the Southern region.

Materials and Methods

The experimental field belongs to the Research Farm of Patuakhali Science and Technology University, Dumki, Patuakhali and covered by the Ganges Tidal Flood Plains under the AEZ–13. The experimental field was medium high in nature and silty clay loam soil having pH value of 6.8. Two HYV *T. aman* rice varieties viz., BRRI dhan46 and BINA dhan7 and four transplanting date *viz.*12 July, 27 July, 12 August and 27 August were used and laid out Randomized Complete Block Design (RCBD) with three replications and plot size was 4.0 × 2.5 m where block to block and plot to plot distance was 1.0 and 0.5 m. The fertilizer were applied such as Gypsum, MOP, TSP, urea and $ZnSO_4$ at the rate of 60, 70, 125, 200 and 10 kg per ha at the time of final land preparation and different vegetative growth stages. The seedlings were transplanted maintaining spacing 20cm X 20cm and different intercultural operations were done properly. Randomly selected five plants in each plot for measures plant height and number of leaves. To get leaf area index (LAI), randomly collected six leaves per hill get five hills of each plot and leaf area was measured by an automatic leaf area meter and finally LAI was calculated with the formula (Radford 1967; Hunt 1978) as follows- LA/P. To get effective and non effective tillers per hill, tillers were counted from each sample and average of five hills of each plot was recorded. Number of total grains per panicle were found through sum of number of filled grains and number of unfilled grains. One thousand cleaned dried seeds were counted randomly from each sample and weighed in gram as 12% moisture basis. The grain and straw yield harvest of the kg per 1 m^2 per plot and converted to ton per ha. Collected data were statistically analyzed through ANOVA technique and evaluated with the help of Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Responses of transplanting date with variety on various growth characters

Plant height: A significant variation was found due to the combined effect of different transplanting date with varieties at 90 days after transplanting. From the Table 1, it was found that the early transplanting of 12 July (1st transplanting) of BRRI dhan46 registered the tallest plant

(95.27 cm) which was statistically differed from other interaction treatments at 90 DAT. Similarly, delay sowing of 27 August (4th transplanting) of BINA dhan7 exhibited the shortest plant (81.01 cm) at same stage. The length of vegetative phase of rice progressively reduced due to delayed planting resulting in short plant height. The results are in conformity with the findings of Salam *et al.* (2004).

Table 1. Interaction effect of transplanting date with varieties on Plant height, Number of leaves per hill, Number of total tillers per hill and Leaf Area Index (LAI) at 90 days after transplanting (DAT)

Transplanting date	Varieties	Plant height (cm) at 90 DAT	Number of leaves hill^{-1} at 90 DAT	Number of total tillers hill^{-1} at 90 DAT	LAI at 90 DAT
12 July	BRRI dhan46	95.27 a	59.27 b	17.97 a	2.932 c
	BINA dhan7	84.58 e	63.10 a	16.80 b	3.294 a
27 July	BRRI dhan46	93.07 b	57.43 d	16.90 b	2.882 cd
	BINA dhan7	83.35 f	58.90 c	16.07 c	3.046 b
12 August	BRRI dhan46	88.39 c	53.83 g	14.50 d	2.777 de
	BINA dhan7	81.23 g	55.83 e	13.50 e	2.861 cd
27 August	BRRI dhan46	86.51 d	51.93 h	13.57 e	2.719 e
	BINA dhan7	81.01 g	54.03 f	12.80 f	2.735 e
CV (%)		0.7437	0.1883	0.1786	1.937

In a column, the means having same letter (s) do not differ significantly but dissimilar letters differ significantly as per DMRT 5% level of significance.

Number of leaves per plant: Significant variation data on leaf production are also presented in Table 1 where it was that the early transplanting of 12 July (1st transplanting) of BINA dhan7 produced significantly the more no. of leaves plant^{-1} (63.10) which was statistically differed from other interaction treatments at 90 DAT. Similarly, 4th transplanting date on 27 August of BRRI dhan46 recorded the least number of leaves plant^{-1} (51.93) at same stage which was also statistically differed from other interaction treatment concerning all the data recording period. As a result, early transplanting of July had longest day period than August transplanting which resulted the more leaf production as well as the early transplanting produce more leaves than delay ones which results are also agreed to the findings of Ahmed (2007).

Number of total tillers per hill: A significant variation was found on number of total tillers per hill due to interaction effect of different transplanting date with varieties at 90 DAT (Table 1). The maximum number of total tiller hill^{-1} had maximum (17.97) in early transplanting (12 July) of the variety BRRI dhan46 followed by the similar transplanting of BINA dhan7 (16.80) at same DAT. On the other hand, delay (27th August) transplanting of BINA dhan7 produced minimum number of total tillers hill^{-1} (12.80) which was statistically differed from other all interactions of the present study. Rakesh and Sharma (2004) who are of the opinion those delay in planting resulted in significant decrease in number of tillers and ultimately the paddy yield.

Leaf Area Index: Interaction effect between transplanting date with studied varieties significantly at 90 days after transplanting (Table 1). The maximum number of leaf area index (3.294) was found from the variety BINA dhan7 in early transplanting at 12 July at 90 DAT while delay transplanting at 27 August (4th transplanting) registered the lowest LAI at those data recording stage (2.735) at same variety which was also statistically identical to same date of BRRI dhan46 at 90 DAT (2.719). Leaf area index showed better response with early sowing (Biswas and Salokhe, 2001).

Responses of transplanting date with variety on various yield contributing characters

Number of effective tillers per hill: Interaction effect of different transplanting date with studied varieties had significant on the number of effective tillers hill^{-1} (Table 2). Among the different interaction treatments, the maximum number of effective tillers (15.63) was observed in early transplanting (12 July) of BRRI dhan46. On the other hand, the variety BINA dhan7 in delay sowing of 27 August registered the minimum number of effective tillers hill^{-1} (9.10) which was statistically differed from other all interactions in this study. Sharma (2004) opinions that delay in planting resulted in significant decrease in number of productive tillers and ultimately reduce the paddy yield.

Number of non–effective tillers per hill: Number of non effective tillers hill^{-1} varied significantly due to interaction effect (Table 2). Among the interaction treatment, delay transplanting (27 August) of BINA dhan7 produced significantly the more non–effective tillers hill^{-1} (2.40). On the other hand, the minimum number of non-effective tillers hill^{-1} (0.833) was observed in early transplanting at 12 July of BRRI dhan46.

Number of total grains per panicle: A significant variation was found due to the combined effect of varieties and their various transplanting date (Table 2). The maximum number of total grains panicle^{-1} (148.0) was found from the 12 July transplanting (early transplanting) of BRRI dhan46. On the other hand, the minimum number of total grains panicle^{-1} (96.87) was obtained from 27 August (delay transplanting) transplanting of BINA dhan7. Akram *et al*. (2007) who reported that number of grains panicle^{-1} were significantly affected as sowing date and decrease with delayed transplanting.

Number of filled grains per panicle: A highly significant difference was found due to the interaction effect between the transplanting date and studied varieties in respect of filled grains panicle^{-1} (Table 2). From the Table 2, the maximum number of filled grains panicle^{-1} (139.40) was obtained from the early (12 July) transplanting of BRRI dhan46 which was statistically differed from other interactions while delay transplanting (27 August)

transplanting of BINA dhan7 recorded the minimum number of filled grains panicle^{-1} (80.47) which was also statistically differed from other interactions.

Weight of 1000- grains: Interaction effect of different transplanting date and varieties showed significant variation in respect of weight of 1000-grains (Table 2). Among the interaction treatments, early transplanting (12 July) of BRRI dhan46 produced the highest 1000-grains weight (27.14 g) which was statistically differed from other interactions. On the other hand, delay transplanting at 27 August of BINA dhan7 produced significantly the lowest 1000–grain weight (20.99 g). Biswas and Salokhe (2001) stated that delay in planting resulted in significant decrease in grains weight.

Table 2. Interaction effect of transplanting date with varieties on various yield and yield contributing characters at harvest

Transplanting date	Varieties	No. of effective tillers hill^{-1}	No. of non–effective tillers hill^{-1}	No.of total grains panicle^{-1}	No.of filled grains panicle^{-1}	Thousand –grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})
12 July	BRRI dhan46	15.63 a	0.833 f	148.0 a	139.4 a	27.14 a	4.650 a	6.187 a	10.84 a
	BINA dhan7	14.43 b	1.033 e	127.0 b	117.7 b	24.26 b	4.287 b	5.983 b	10.27 b
27 July	BRRI dhan46	14.53 b	0.967 e	127.2 b	115.5 c	25.47 b	4.090 c	5.723 c	9.813 c
	BINA dhan7	13.23 c	1.300 d	120.2 c	107.8 d	24.28 b	3.977 d	5.770 c	9.747 c
12 August	BRRI dhan46	11.43 d	1.633 c	118.2 d	105.7 e	22.76 c	3.943 d	5.610 d	9.553 d
	BINA dhan7	9.867 e	2.167 b	103.5 f	88.43 g	21.18 d	3.557 e	5.320 e	8.877 e
27 August	BRRI dhan46	10.03 e	2.133 b	108.2 e	93.50 f	21.37 d	3.437 f	4.990 f	8.427 f
	BINA dhan7	9.100 f	2.400 a	96.87 g	80.47 h	20.99 d	3.117 g	4.790 g	7.907 g
CV (%)		0.2147	0.1191	1.395	1.937	1.203	0.05954	0.05954	0.0842

In a column, the means having same letter (s) do not differ significantly but dissimilar letters differ significantly as per DMRT 5% level of significance

Grain yield: Interaction effect of transplanting date with varieties showed significant variation in respect of grain yield (Table 2). From the Table 2, the highest grain yield (4.650 t ha^{-1}) was obtained from the 12 July transplanting of BRRI dhan46 which was statistically differed from other all interactions while delay transplanting at 27 August of BINA dhan7 gave the lowest grain yield (3.117 t ha^{-1}) which was statistically differed from other all interactions. Shah and Bhurer (2005) reported that early seeding recorded significantly the highest grain yield and decreased with the delay in sowing.

Straw yield: Combined effect of different transplanting date with varieties showed significant variation in straw yield (Table 2). The highest straw yield (6.187 t ha^{-1}) was obtained from 12 July transplanting of BRRI dhan46 which was statistically differed from other all interactions.

Similarly, the lowest straw yield (4.790 t ha^{-1}) was taken from the variety BINA dhan7 at delay transplanting (27 August) which was also statistically differed from other interactions. Salam *et al.* (2004) observed that straw yield linearly decreased with the delay of transplanting.

Biological yield: Interaction effect between different transplanting dates with varieties showed significant variation on biological yield (Table 2). From the Table 2, it was found that the higher biological yield (10.84 t ha^{-1}) was produced from the early transplanting of 12 July of BRRI dhan46 while delay transplanting of 27 August of BINA dhan7 obtained the lowest biological yield (7.907 t ha^{-1}) whereas all the interactions were statistically different with each other regarding biological yield.

From the investigated above summary it was found that the early transplanting of 12 July than other transplanting date and the variety BRRI dhan46 exhibited the superior performance than BINA dhan7 almost all the tested parameters. So, it was confirmed that the early transplanting of 12 July was the optimum transplanting date and the variety BRRI dhan46 was the most suitable variety than BINA dhan7 for obtaining the greater production of rice under the Southern region.

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