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EFFECT OF SEEDLING AGE AND METHOD OF TRANSPLANTING ON THE YIELD OF AMAN RICE

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ABSTRACT

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh from June to December 2012 with a view to finding out the effect of seedling age and method of transplanting on the yield of *Aman* rice. Four seedling ages (10, 20, 30 and 40 days) and two transplanting methods (line and haphazard) were used as experimental treatments with four replications in a randomized complete block design. Seedling age, transplanting method and their interaction significantly influenced most of the yield components and yield of transplant *Aman* rice cv. BRRI dhan41. The highest total tillers, effective tillers hill^{-1}, grains panicle^{-1}, grain yield, straw yield and harvest index were obtained from 30-day-old seedlings. Line transplanting method produced the highest total tillers, effective tillers hill^{-1}, grain yield and harvest index. The highest total tillers, effective tillers hill^{-1}, grain yield and harvest index were obtained from 30-day-old seedlings with line transplanting method. Results revealed that 30-day-old seedlings under line transplanting method could be used to obtain maximum yield of transplant *Aman* rice cv. BRRI dhan41.

Key Words: Seedling age, Transplanting method, Yield, Transplant *Aman* rice

INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food and major cereal crop of Bangladesh. It is the extensively cultivated crop for half of the world's population (FAO, 2010). It is grown throughout the year in the country, but the yield of this crop is low (HasanuzzAman *et al*., 2009). In Bangladesh transplant *Aman* rice contributes about 44.12% of the total rice production and covers 52.75% of the total rice area but the average yield is below the potential level (BBS, 2011). Age of seedling is an important factor to obtain higher yield of rice because it has tremendous influence on the tiller production, grain formation and other yield attributes. The use of over aged seedlings retards the general performance of crop and reduces the yield of crop (Bozorgi *et al*., 2011). For optimum yield, seedling age of a particular variety may not be suitable for other varieties. It is, therefore, needed to find out the optimum seedling age for recently introduced high yielding varieties of rice to produce higher yield.

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Method of transplanting is another factor to be considered for rice cultivation. In main field, plant can be transplanted in two ways- transplanting in line and transplanting haphazardly. Transplanting in line is found better than transplanting haphazardly in terms of practicing intercultural operations and obtaining higher yield. On the other hand, haphazard transplanting requires less time and labour than that of transplanting in line (Ganajaxi *et al*., 2000). Therefore, it is necessary to examine not only seedling age but also transplanting method of *Aman* rice to ensure higher yield. The present research was, therefore, undertaken to determine the effects of seedling age and transplanting method on the yield of *Aman* rice.

MATERIALS AND METHODS

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh from June to December 2012. The land of the experimental area was medium high with moderate drained condition. The soil was silty loam in texture having a pH value of 6.43, moderate in organic matter content (UNDP and FAO, 1988).

The experimental treatments consisted of two factors (A) four seedling ages, viz. (i) 10-day-old (S_1), (ii) 20-day-old (S_2), (iii) 30-day-old (S_3) and 40-day-old (S_4) and (B) two transplanting methods, viz. (i) transplanting in line (M_1) and (ii) haphazard transplanting (M_2). The experiment was laid out in a randomized complete block design with four replications. Treatment combinations were assigned at random in block. The unit plot size was 4.0 m × 2.5 m. BRRI dhan41 was used as the test cultivar in the study. The land was well prepared to puddle condition. All weeds and stubbles were removed. The experimental plots were fertilized with urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate @ 180, 100, 70, 60, and 10 kg ha^{-1}, respectively. Seedlings were transplanted in line at the rate of two seedlings $hill^{-1}$ maintaining a spacing of 25 cm × 15 cm, and the haphazard transplanting was done without spacing. Different intercultural operations were done as and when necessary.

The crop of each plot was harvested at maturity. Data on different plant characters were recorded from the five randomly selected hills in each plot and those on grain and straw yields were recorded from central 1 m^2 area of each plot. The data were compiled and tabulated in proper form and subjected to statistical analysis. Analysis of variance was done with the help of computer package MSTAT-C program. The significant differences between individual means were performed using Duncan's Multiple Range Test (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effect of seedling age

There was significant difference in plant height due to the effect of seedling age (Table 1). The tallest plant (126.26 cm) was recorded from 40-day-old seedlings. The shortest plant (122.18 cm) was obtained from 10-day-old seedlings which was statistically identical with

30-day-old seedlings. Significant variation in plant height was also observed due to variation in seedling age (Khatun *et al*., 2002). Seedling age had significant effect on number of total tillers hill^{-1}. The highest number of total tillers hill^{-1} (10.62) was obtained from 30-day-old seedlings. The lowest number of total tillers hill^{-1} (8.32) was obtained from 10-day-old seedlings. The result showed that younger seedlings produced less tillers than the older ones. Roy and Sattar (1992) reported similar findings observing less tiller number in younger seedlings compared to older ones. Number of effective tillers hill^{-1} varied significantly due to the age of seedlings. The highest number of effective tillers hill^{-1} (7.97) was observed from 30-day-old seedlings. The lowest number of effective tillers hill^{-1} (4.49) was produced from 10-day-old seedlings. Number of non-effective tillers hill^{-1} was influenced significantly by seedling age. The highest number of non-effective tillers hill^{-1} (3.83) was observed from 10-day-old seedlings. Thirty-day-old seedlings produced the lowest number (2.85) of non-effective tillers hill^{-1} (Table 1). From the results it was observed that younger seedlings produced more non-effective tillers hill^{-1} than the older ones.

It is observed that panicle length was significantly influenced by the age of seedlings (Table 1). Forty-day-old seedlings produced the longest panicle (24.00 cm) which was statistically at par with 20 and 30-day-old seedlings and the shortest one (22.90 cm) from 10-day-old seedlings. The effect of seedling age on grains panicle^{-1} was found significant. The highest number of grains panicle^{-1} (169.07) was obtained from 30-day-old seedling which was statistically identical with that of 40-day-old seedlings. The lowest number of grains panicle^{-1} (120.60) was obtained from 10-day-old seedlings. Seedling age had significant effect on the production of sterile spikelets panicle^{-1}. The highest number of sterile spikelets panicle^{-1} (30.79) was obtained from 10-day-old seedlings whereas the lowest number (23.04) was obtained from 30-day-old seedlings. Seedling age had significant effect on 1000-grain weight. The highest 1000-grain weight (27.21) was obtained from 40-day-old seedlings and the lowest one (26.12) from 10-day-old seedlings (Table 1).

Grain yield was significantly influenced by seedling age (Table 1). The highest grain yield (5.10 t ha^{-1}) was obtained from 30-day-old seedlings. The lowest grain yield (3.95 t ha^{-1}) was obtained from 10-day-old seedlings. The highest grain yield obtained from 30-day-old seedlings might be attributed to the highest number of effective tillers hill^{-1}, highest number of grains panicle^{-1}, and lowest number of sterile spikelets panicle^{-1} in this treatment. The results showed that grain yield decreased with decreasing seedlings age from 30-day. Our results were in accordance with those of Khatun *et al*. (2002) and Alam *et al*. (2002), who reported decreasing grain yield with the decrease of seedling age. Seedling age had a significant effect on straw yield. The highest straw yield (5.69 t ha^{-1}) was obtained from 40-day-old seedling which was statistically identical with

30-day-old seedlings. The lowest straw yield (4.92 t ha^{-1}) was obtained from 10-day-old seedlings. Seedling age had significant effect on harvest index. The highest harvest index (47.87%) was obtained from 30-day-old seedlings and the lowest harvest index (44.44%) was found from 10-day-old seedlings (Table 1).

Table 1. Effect of seedling age on the yield attributes and yield of transplant *aman* rice cv. BRRI dhan41

Seedling age	Plant height (cm)	Total tillers hill^{-1} (no.)	Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} (no.)	Panicle length (cm)	Grains panicle^{-1} (no.)	Sterile spikelets panicle^{-1} (no.)	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
10-day-old	122.18c	8.32d	4.49d	3.83a	22.90b	120.60c	30.79a	26.12c	3.95c	4.92c	44.44c
20-day-old	124.22b	9.07c	6.02c	3.05a	23.70a	131.84b	25.57bc	26.55bc	4.83b	5.39b	47.23ab
30-day-old	123.87bc	10.62a	7.97a	2.65b	23.41ab	169.07a	23.04c	26.75ab	5.10a	5.56a	47.87a
40-day-old	126.26a	10.04b	6.53b	3.51a	24.00a	162.51a	27.87b	27.21a	4.93b	5.69a	46.41b
CV (%)	4.5	3.47	4.31	9.39	4.31	6.59	10.11	3.94	3.96	3.54	4.76
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05	0.01	0.01	0.01

Means within the column having the same letters are not significantly different as per DMRT

Effect of transplanting method

Plant height was significantly influenced by the transplanting methods (Table 2). The taller plant (126.22 cm) was found from transplanting in line and the shorter one (122.05 cm) from haphazard transplanting. Number of total tillers hill^{-1} was significantly influenced by transplanting method. Transplanting in line produced higher number of total tillers hill^{-1} (10.16) and the lower one (8.87) was produced from haphazard transplanting. Transplanting method had significant effect on number of effective tillers hill^{-1}. The higher number of effective tillers hill^{-1} (6.63) was observed in line transplanting. The lower number of effective tillers hill^{-1} (5.88) was produced in haphazard transplanting. Transplanting method had significant effect on non-effective tillers hill^{-1}. The higher number of non-effective tillers hill^{-1} (3.53) was observed under line transplanting method and the lower number of non-effective tillers hill^{-1} (2.99) was found under haphazard transplanting (Table 2).

Panicle length was significantly influenced by planting methods studied (Table 2). Haphazard transplanting produced the longer panicle (23.76 cm) and the lower one (23.24 cm) was recorded from line transplanting method. Grains panicle^{-1} varied significantly by transplanting method. The higher grains panicle^{-1} (152.27) was found in haphazard transplanting and the lower one (139.74) was observed in line transplanting method. Sterile spikelets panicle^{-1} was significantly influenced by the method of transplanting. The higher number of sterile spikelets panicle^{-1} (29.88) was obtained from haphazard transplanting whereas the lower one (23.76) from line transplanting method (Table 2).

Transplanting method had significant effect on grain yield (Table 2). The higher grain yield (4.89 t ha^{-1}) was found from line transplanting method and the lower one (4.51 t ha^{-1}) from haphazard transplanting method. The higher grain yield obtained from line transplanting might be due to higher number of effective tillers hill^{-1} and lower number of sterile spikelets panicle^{-1} found in this treatment. Method of transplanting had significant effect on straw yield. The higher straw yield (5.49 t ha^{-1}) was found from line transplanting and the lower straw yield (5.29 t ha^{-1}) from haphazard transplanting method. Harvest index varied significantly by transplanting method. The higher harvest index (47.08%) was obtained from line transplanting method and the lower one (45.89%) from haphazard transplanting method (Table 2).

Interaction effect of seedling age and transplanting method

The interaction between seedling age and transplanting method had significant effect on plant height (Table 3). The tallest plant (128.97 cm) was found from 40-day-old seedlings under haphazard transplanting and the shortest one (120.53 cm) from 10-day-old seedlings under line transplanting method. Interaction between seedling age and transplanting method had significant effect on number of total tillers hill^{-1}. The highest number (11.62) of total tillers hill^{-1} was obtained from 30-day-old seedlings under line transplanting method and the lowest one (8.57) was produced from haphazard transplanting of 20-day-old seedlings. Interaction between seedling age and transplanting method had significant effect on number of effective tillers hill^{-1}.

Table 2. Effect of transplanting method on the yield attributes and yield of transplant *aman* rice cv. BRRI dhan41

Transplanting method	Plant height (cm)	Total tillers hill^{-1} (no.)	Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} (no.)	Panicle length (cm)	Grains panicle^{-1} (no.)	Sterile spikelets panicle^{-1} (no.)	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
Line transplanting	122.05b	10.16a	6.63a	3.53a	23.24b	139.74b	23.76b	26.38	4.89a	5.49a	47.08a
Haphazard transplanting	126.22a	8.87b	5.88b	2.99b	23.76a	152.27a	29.88a	26.93	4.51b	5.29b	45.89b
CV (%)	4.8	4.42	4.38	8.29	4.37	6.43	10.52	3.74	3.16	5.52	5.73
Level of significance	0.01	0.01	0.01	0.01	0.05	0.01	0.01	NS	0.01	0.01	0.01

Means within the column having the same letters are not significantly different as per DMRT; NS = Not significant

Table 3. Interaction effect of seedling age and transplanting method on the yield attributes and yield of transplant *aman* rice cv. BRRI dhan41

Interactions (S × M)	Plant height (cm)	Total tillers hill^{-1} (no.)	Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} (no.)	Panicle length (cm)	Grains panicle^{-1} (no.)	Sterile spikelets panicle^{-1} (no.)	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
S_1M_1	120.53d	8.67d	4.69d	3.98	23.03	120.27c	25.29c	26.22	4.36e	5.17d	45.79c
S_1M_2	123.82b	7.97e	4.29e	3.68	22.78	120.93c	36.29a	26.02	3.54f	4.67e	43.10d
S_2M_1	120.74cd	9.57c	6.19c	3.39	23.18	134.85c	23.76cd	26.30	4.95bc	5.43bc	47.69ab
S_2M_2	127.71a	8.57d	5.86c	2.71	24.22	128.83c	27.38bc	26.79	4.71d	5.36cd	46.77bc
S_3M_1	123.36bc	11.62a	8.71a	2.91	22.95	153.20b	20.23d	26.10	5.25a	5.60ab	48.41a
S_3M_2	124.38b	9.61c	7.22b	2.39	23.86	184.95a	25.85bc	27.39	4.95bc	5.52bc	47.32ab
S_4M_1	123.56bc	10.76b	6.91b	3.85	23.79	150.64b	25.75bc	26.91	5.00b	5.77a	46.45bc
S_4M_2	128.97a	9.32c	6.15c	3.17	24.20	174.38a	29.98b	27.51	4.85c	5.63ab	46.37bc
CV (%)	4.8	3.47	4.31	7.35	4.31	6.52	10.17	3.94	3.96	3.54	4.58
Level of significance	0.05	0.01	0.01	NS	NS	0.01	0.05	NS	0.01	0.05	0.05

Means within the column having the same letters are not significantly different as per DMRT; NS = Not significant, S_1 = 10-day-old seedling, S_2 = 20-day-old seedling, S_3 = 30-day-old seedling, S_4 = 40-day-old seedling; M_1 = Line transplanting, M_2 = Haphazard transplanting

The highest number of effective tillers hill^{-1} (8.71) was observed from 30-day-old seedlings under line transplanting and the lowest number of effective tillers hill^{-1} (4.29) was produced from 10-day-old seedlings under haphazard transplanting. Number of grains panicle^{-1} was significant by the interaction between seedling age and transplanting method. The highest number of grains panicle^{-1} (184.95) was observed from 30-day-old seedlings under haphazard transplanting. The lowest number of grains panicle^{-1} (120.27) was produced from 10-day-old seedlings under line transplanting. Interaction between seedling age and transplanting method had significant effect on number of sterile spikelets panicle^{-1}. The highest number of sterile spikelets panicle^{-1} (36.29) was observed from 10-day-old seedlings under haphazard transplanting method. The lowest number of sterile spikelets panicle^{-1} (20.23) was produced from 30-day-old seedlings under line transplanting method (Table 3).

Interaction between seedling age and transplanting method had significant effect on grain yield (Table 3). The highest grain yield (5.25 t ha^{-1}) was observed from 30-day-old seedlings under line transplanting method. The lowest grain yield (3.54 t ha^{-1}) was produced from 10-day-old seedlings from haphazard transplanting method. Harvest index was significantly influenced by the interaction between seedling age and transplanting method. The highest harvest index (48.31%) was observed from 30-day-old seedlings under line transplanting method. The lowest harvest index (43.10%) was produced from 10-day-old seedlings under haphazard transplanting method (Table 3).

From the study, it is observed that yield attributes and yield of transplant *Aman* rice cv. BRRI dhan41 varied significantly due to variation in seedling age under different transplanting methods. It is revealed from the results that 30-day-old seedlings performed better under line transplanting method. In conclusion, it can be said that 30-day-old seedlings of BRRI dhan41 under line transplanting method could be used to attain higher yield.

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