



EFFECT OF SEEDLING AGE AND SEEDLING NUMBER PER HILL ON YIELD AND YIELD ATTRIBUTES OF TRANSPLANTED AMAN RICE (BR23)

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Abstract: The effect of seedling age and seedling number per hill on yield and yield contributing characters of Transplant *Aman* rice in Khulna region was investigated from July to December 2002. The treatments included in the experiment consisted of 4 seedling age (viz. 15, 25, 35 and 45 day old seedling) and 5 seedling number hill⁻¹ (viz. 1, 2, 3, 4 and 5). It was found that 25 day old seedling produced the tallest plant (118.87 cm), highest number of total tiller hill⁻¹ (33.02), number of effective tiller hill⁻¹ (30.37), longest panicle length (25.85 cm), highest number of grain panicle⁻¹ (154.33), grain yield (5.14 t ha⁻¹) and harvest index (43.28). Number of seedlings hill⁻¹ had significant effect on plant height, total tillers hill⁻¹, effective tillers hill⁻¹, number of grains panicle⁻¹, 1000 grain weight, grain yield and harvest index. The highest number of total tillers hill⁻¹ (34.25), effective tillers hill⁻¹ (32.11), number of grains panicle⁻¹ (161.72), grain yield (5.19 t ha⁻¹) and harvest index (45.72%) were found when two seedlings were planted hill⁻¹. The highest value for 1000 grain weight (23.67g) was recorded when one seedling was planted hill⁻¹. It was evident that two seedlings hill⁻¹ with 25 day old seedling showed better performance in respect of growth and yield of rice.

Key words: Seedling age, seedling number, rice

Introduction

Rice is the prime source of food for one third of the world's population. It is also the staple food of Bangladesh (Anonymous, 1996). The people of Bangladesh receive 76% calorie and 66% protein from rice. The population of Bangladesh was 108.30 million in the year 1990 and it would be 153.30 million and 189.90 million in the year 2010 and 2015, respectively (Shahiduzzaman, 2001). Projected supply and demand balance shows that the country will require 34-35 million m ton of food grains by the year 2020 while the supply would be 27-33 million ton under two alternative-case -scenario (Shahabuddin *et al.*, 1999). Rice yield in Bangladesh is very low (2.6 t ha⁻¹) than other principal rice growing countries like China, Japan, Korea and Egypt (5.7, 5.9, 7.5 and 7.3 t ha⁻¹, respectively) (Choi, 2000). This is mainly due to wide gap between potential yield and actual yield in our country. Improper and poor management practices mainly account for such a wide yield gap that might be minimized.

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The performance of older seedlings may be affected by variety, time of planting and air temperature and other management practices. Researchers from both home and abroad have shown that 25-30°C air temperature was the best for growth of the seedling (Yoshida, 1981). Younger seedlings are more susceptible to transplant shock and cold having more mortality during post establishment period (Padalia and Rao, 1980). On the other hand, older seedlings recover slowly particularly when injured during uprooting and produce fewer tillers, delay maturity and may reduce yield (De Datta, 1981). Therefore, decisions about seedlings age need to be adjusted to match growing season and climatic differences as well as local conditions. Seedling(s) hill⁻¹ is an important factor for the growth and yield of rice. Optimal population density and leaf area influence the availability of sunlight and nutrients for growth and development (Donald, 1963). In the light of the above background, the present research work was undertaken to study the effect of seedling age and number of seedling hill⁻¹ on yield of transplant *Aman* rice (BR23).

Materials and Methods

The experiment was conducted at the Agrotechnology Field Laboratory of Khulna University during the Transplant *Aman* season 2002. The experiment was laid in factorial Randomized Complete Block Design with three replications. Four ages of seedlings viz. 15, 25, 35 and 45 days and 5 numbers of seedlings per hill viz. 1, 2, 3, 4 and 5 was included in the experiment. Seeds of BR23 were collected from BADC Seed Distribution Centre, Phultola, Khulna. The experimental plots were fertilized with Urea (130 kg N ha⁻¹), TSP (100 kg P₂O₅ ha⁻¹) and MP (70 kg K₂O ha⁻¹). Weeding was done twice. No remarkable infestation of insect or infection due to any disease organism was noticed in the field. Data were recorded on plant height, number of total and effective tillers hill⁻¹, panicle length (cm), number of grains panicle⁻¹, weight of 1000-grains (g), grain yield (t ha⁻¹), straw yield (t ha⁻¹) and harvest index (%). All the collected data were analyzed following the analysis of variance technique and mean differences were adjudged by Duncan's New Multiple Range Test (Gomez and Gomez, 1984) using a computer operated programme named MSTAT.

Results

Plant height: Plant height was significantly influenced by seedling age (Table 1). It was found that 25 day old seedling produced the tallest plant (118.87 cm) which was statistically similar with 15 and 45 day old seedling. The 35 day old seedling produced the shortest plant (112.49 cm). Plant height was significantly influenced by seedling number hill⁻¹ (Table 2). Five seedlings hill⁻¹ produced the tallest plant (120.87 cm) followed by four (118.77 cm), three (116.01 cm) and two (115.95 cm) seedlings hill⁻¹. The shortest plant (110.19 cm) was produced in case of one seedling hill⁻¹. It is evident from the result that plant height increased with increasing number of seedling hill⁻¹. The result is in agreement with Singh (1990) but in conflict with Islam *et al.* (1994).

Total tillers: The number of total tiller per hill was also influenced significantly by seedling age (Table 1). The highest number of total tiller hill⁻¹ (33.02) was produced by 25 day old seedling and the lowest number (26.64) by 45 day old seedling. The younger seedling produced the highest number of tillers and the oldest one the lowest. Aragones

and Wada (1989) also reported that transplanting of younger seedling had a positive influence in increasing the number of tillers. Number of total tillers hill⁻¹ varied significantly among the number of seedlings hill⁻¹ (Table 2). The highest number of tillers hill⁻¹ (34.25) was produced by two seedlings hill⁻¹. The lowest number of total tillers (28.22) was found in four seedlings hill⁻¹. The results compare favorably with those of Nakano and Mizushima (1994), Yamamoto *et al.* (1994) and Islam *et al.* (1994) but disagreed with Ramasamy *et al.* (1987).

Table 1. Effect of seedling age on growth and yield contributing characteristics of rice (BR23).

Seedling Age (days)	Plant height (cm)	Total tillers hill ⁻¹ (no)	Effective tillers hill ⁻¹ (no)	Panicle length (cm)	Number of grains panicle ⁻¹ (no)	1000 grain weight (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	Harvest index (%)
15	115.40 ^{ab}	31.04 ^{ab}	29.13 ^{ab}	25.78	149.35	23.64	5.09 ^a	7.20	41.58 ^{ab}
25	118.87 ^a	33.02 ^a	30.37 ^a	25.85	154.33	23.64	5.14 ^a	6.83	43.28 ^a
35	112.49 ^b	28.31 ^{bc}	25.60 ^b	25.62	140.22	23.65	4.64 ^b	6.75	41.03 ^{ab}
45	118.67 ^a	26.64 ^c	24.69 ^b	25.49	139.24	23.61	4.51 ^b	7.26	38.51 ^b
Level of significance	**	**	**	NS	NS	NS	**	NS	*

Mean values in a column having the same letter (s) do not differ significantly.

NS = Not significant; * = Significant at 5% level; ** = Significant at 1% level

Effective tillers: Seedling age influenced significantly the number of effective tiller hill⁻¹ (Table 1). The highest number of effective tillers was found in 25 day old seedlings followed by 15 day old seedlings and it was lowest in 35 day old seedlings. The younger seedlings produced the highest number of effective tillers and the oldest one produced the lowest. Seedling number hill⁻¹ had significant effect on the number of effective tillers hill⁻¹ (Table 2). The highest number of effective tillers hill⁻¹ (32.11) was obtained from two seedlings which was statistically similar with that of three seedlings hill⁻¹. The lowest (25.33) was obtained from five seedlings hill⁻¹. Almost similar result was found by Nakano and Mizushima (1994); but Ramasamy (1987) recorded dissimilar results with the present study.

Table 2. Effect of seedlings number hill⁻¹ on growth and yield contributing characters of rice (BR23).

Seedling Number	Plant height (cm)	Total tiller sshill ⁻¹ (no)	Effective tillers hill ⁻¹ (no)	Number of grains panicle ⁻¹ (no)	1000 grain weight (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	Harvest index (%)
1	110.19 ^b	28.25 ^b	26.50 ^b	149.27 ^{ab}	23.67 ^a	4.67 ^b	7.00 ^b	40.03 ^b
2	115.95 ^{ab}	34.25 ^a	32.11 ^a	161.72 ^a	23.65 ^{ab}	5.19 ^a	6.24 ^a	45.72 ^a
3	116.01 ^{ab}	29.70 ^b	27.89 ^{ab}	147.27 ^{ab}	23.65 ^{ab}	5.00 ^{ab}	7.24 ^a	41.20 ^{ab}
4	118.77 ^a	28.22 ^b	25.41 ^b	133.89 ^b	23.59 ^c	4.61 ^b	7.34 ^a	38.82 ^b
5	120.87 ^a	28.36 ^b	25.33 ^b	136.77 ^b	23.61 ^{bc}	4.76 ^{ab}	7.23 ^a	39.72 ^b
Level of significance	**	**	**	**	*	**	*	*

Mean values in a column having the same letter (s) do not differ significantly. * = Significant at 5% level; ** = Significant at 1%

Number of grains panicle⁻¹: It was found from the analysis of variance that seedling age had no significant effect on number of grains panicle⁻¹. Number of grains panicle⁻¹ was significantly influenced by seedling number per hill (Table 2). It was found that two seedlings hill⁻¹ produced the highest number of filled grain panicle⁻¹ (161.72) and the

lowest number of filled grain panicle⁻¹ (133.89) was recorded from four seedlings hill⁻¹. Number grains panicle⁻¹ decreased with the increasing of seedling number hill⁻¹.

Weight of 1000 grains: The weight of 1000 grains was not significantly affected by seedling age. Seedling number hill⁻¹ influenced significantly the weight of 1000 grains (Table 2). The highest weight was found when one seedling was transplanted hill⁻¹ and lowest in case of four seedlings hill⁻¹.

Grain yield: Grain yield differed significantly due to the effect of seedling age (Table 1). It was evident from the table that 25 day old seedlings produced the highest grain yield (5.14 t ha⁻¹) which was statistically similar with 15 day old seedlings (5.09 t ha⁻¹). The lowest grain yield (4.51 t ha⁻¹) was obtained from 45 day old seedlings. Number of seedlings hill⁻¹ influenced significantly the grain yield of BR23 rice (Table 2). It was evident that two seedlings hill⁻¹ produced the highest grain yield. (5.19 t ha⁻¹) and the lowest grain yield (4.61 t ha⁻¹) was obtained from four seedlings hill⁻¹. This result was also agreed with Nakano and Mizushima (1994). Grain yield increased with the increase of number of seedlings and seedling age. It was probably due to production of maximum number of tillers hill⁻¹, number of grains panicle⁻¹ and higher 1000 grain weight.

Straw yield: Seedling age had no significant effect on the straw yield (Table1). The seedling number hill⁻¹ had significant effect on the straw yield (Table 2). The highest straw yield (7.34 t ha⁻¹) was found in four seedlings hill⁻¹ and the lowest (6.03 t ha⁻¹) in two seedlings hill⁻¹.

Harvest index: The harvest index varied significantly due to the effect of seedling age (Table 1). It was evident that the highest harvest index (43.28%) was found with 25 day old seedlings which was statistically similar to that of 15 day and 35 day old seedlings and significantly different from 45 day old seedlings in which the harvest index was the lowest (38.51%). Seedling number hill⁻¹ had significant effect on harvest index (Table 2). The highest harvest index (45.72%) was obtained from two seedlings hill⁻¹. On the other hand the lowest harvest index (38.82%) was obtained from four seedlings hill⁻¹.

Interaction effect of seedling age and seedling number: Interaction effect of number of seedlings hill⁻¹ and seedling age was found insignificant in all characters studied in this experiment (Table 3). However, numerically the highest panicle length (28.54 cm), number of filled grains panicle⁻¹ (188.55), number of total grains panicle⁻¹ (211.77) and grain yield (5.55 t ha⁻¹) were found in the treatment combination of two seedlings hill⁻¹ with 25 day old seedlings.

Discussion

It was found that 25 day old seedling produced the tallest plant (118.87 cm) which was statistically similar with 15 and 45 day old seedling. The result is in agreement with Singh (1990) but in conflict with Islam *et al.* (1994). The number of total tiller hill⁻¹ was also influenced significantly by seedling age. The highest number of total tiller hill⁻¹ (33.02) was produced by 25 day old seedling and the lowest number (26.64) by 45 day old seedling. The results compare favorably with those of Nakano and Mizushima (1994), Yamamoto *et al.* (1994) and Islam *et al.* (1994) but disagreed with Ramasamy *et al.* (1987).

Seedling age influenced significantly the number of effective tiller hill⁻¹ (Table 1). The highest number of effective tillers was found in 25 day old seedlings followed by 15 day old seedlings and it was lowest in 35 day old seedlings. Almost similar result was found by Nakano and Mizushima (1994); but Ramasamy (1987) recorded dissimilar results with the present study.

It was found from the analysis of variance that seedling age had no significant effect on number of grains panicle⁻¹. Number of grains panicle⁻¹ was significantly influenced by seedling number hill⁻¹. It was found that two seedlings hill⁻¹ produced the highest number of filled grain panicle⁻¹ (161.72) and the lowest number of filled grain panicle⁻¹ (133.89) was recorded from four seedlings hill⁻¹. Number of grains panicle⁻¹ decreased with the increasing of seedling number hill⁻¹. The weight of 1000 grains was not significantly affected by seedling age. Seedling number hill⁻¹ influenced significantly the weight of 1000 grains. The highest weight was found when one seedling was transplanted hill⁻¹ and lowest in case of four seedlings hill⁻¹.

It was evident from the result that 25 day old seedlings produced the highest grain yield (5.14 t ha⁻¹) and the lowest grain yield (4.51 t ha⁻¹) was obtained from 45 day old seedlings. Number of seedlings hill⁻¹ influenced significantly the grain yield of BR23 rice. It was revealed that two seedlings hill⁻¹ produced the highest grain yield. (5.19 t ha⁻¹) and the lowest grain yield (4.61 t ha⁻¹) was obtained from four seedlings hill⁻¹. This result was also agreed with Nakano and Mizushima (1994). Grain yield increased with the increase of number of seedlings and seedling age. It was probably due to production of maximum number of tillers hill⁻¹, number of grains panicle⁻¹ and higher 1000 grain weight.

Conclusion

It can be concluded from the result of the present study that transplanted *Aman* rice variety BR23 can be produced successfully when 25 day old seedlings are planted at the rate of two seedlings per hill.

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