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EFFECT OF DIFFERENT SEEDLING AGES AND VARIETIES ON THE GROWTH AND YIELD OF TRANSPLANT AMAN RICE

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ABSTRACT

An experiment was carried out during July to December 2006 to study the effect of aged of seedlings and varieties on the yield performance of transplant aman rice. The study included three varieties of rice viz., BRRI dhan40, BRRI dhan4l and Nizersail and three seedling ages viz., 40, 60 and 80 days. Age of seedlings affected the tillering behavior. Seedlings of 40 days old produced more number of tillers hill^{-1} than the others. The highest grain yield, weight of 1000-grains, straw yield, biological yield and harvest index were found in BRRI dhan4l. Nizersail produced the maximum number of noneffective tillers hill^{-1} and the highest number of unfilled grains panicle^{-1}. The highest number of effective tillers hill^{-1}, grains panicle^{-1}, grain yield, straw yield, biological yield and harvest index were obtained from the crop raised with 40 days old seedlings. The highest grain yield (6.31 t ha^{-1}) was obtained from BRRI dhan4l with 40 days old seedlings.

Key words: *Growth, seedling ages, variety, yield of rice*

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the major and most extensively cultivated cereals of the world. It is the most important cereal crop in Asia where about 92% of the world rice is grown (IRRI, 1995). Agriculture in Bangladesh is characterized by intensive crop production with the rice based cropping systems. The soil and climate, of Bangladesh are favourable for its cultivation throughout the year. Age of seedling is an important factor and has tremendous influence on the tiller production, grain formation and other yield contributing characters (Singh *et al*., 1990). The Bangladesh Rice Research Institute has recommended the seedling age of rice for transplanting based on the growing season, such as, 20-30 days for aus season, 20-35 days for transplant aman season and 45 days for boro season (BRRI, 1991b and BRRI, 1992). Generally, the farmers of our country do not give attention to the age of seedlings at transplanting and use aged seedlings. The use of over aged seedlings retard the general performance of crop growth and the yield of crop reduces drastically (Mahapatra *et al*., 1990). For the optimum yield, age of seedlings at transplanting of a particular variety at particular season may not be suitable for other varieties at other season. So, it is very important to find out the optimum age of seedlings of a particular variety far a particular season. In Bangladesh, little research work has so for been done to identify the optimum seedling age, particularly with the modern variety like BRRI dhan40 and BRRI dhan4l. Yield loss of transplant aman rice can be mitigated by cultivating suitable cultivars by adopting proper agronomic practices of which age of seedling is important. Management of plant population, planting technique and inputs play a vital role in rice production. Among the inputs, variety, comes first for higher yield. In view of the above discussions, the present study was undertaken with the following objectives: i) to find out the effect of different seedling ages for maximizing the yield of transplant aman rice, ii) to observed the performance of BRRI dhan40, BRRI dhan4l and Nizersail under transplant aman condition and iii) to find out the interactions, if any,

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between seedling ages and variety on the yield and yield attributes as affected under transplanted condition.

MATERIALS AND METHODS

The experiment was carried out during the period of July – December, 2006 at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, to study the response of aman rice to different aged seedlings and different varieties. The study included three seedling ages viz., 40, 60 and 80 days old seedling and three transplant aman rice varieties viz., BRRI dhan40, BRRI dhan4l and Nizersail. The experimental site was located under "AEZ-9" having the non-calcareous dark-gray flood plain soil of the Old Brahmaputra Flood plain Agro-Ecological region (UNDP and FAO, 1988).

The experiment was laid out in split plot design with three replications accommodating variety in the main plot and age of seedling of different ages in the sub plot. The unit plot size was 4.0 m x 2.5 m. The land was fertilized with recommended rates of urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate and l/3rd of urea was applied as basal dose. Rest of urea was trop dressed in two equal splits on 15 days and 30 days after transplanting. Forty, 60 and 80 days old seedlings of three rice varieties were transplanted on 17 September 2006, at the rate of three seedlings hill^{-1} with 25 cm X 15 cm spacing. Intercultural operations such as weeding, water management and pest management was taken when necessary. Ten plants (excluding border hills) were randomly selected from each unit plot within 5 m^2 harvest area at the center for recording data at harvest. From the experimental plots data were collected on Plant height (cm), Number of total tillers hill^{-1}, Number of effective tillers hill^{-1}, Number of non-effective tillers hill^{-1}, Number of grains panicle^{-1}, Number of sterile spikelets panicle^{-1}, Weight of 1000-grains (g), Grain yield (t ha^{-1}) and Straw yield (t ha^{-1})
Data recorded for different parameters were compiled and tabulated in proper form for statistical analysis. Aanalysis of variance was done f'ollowing Split-plot design with the help of computer package MSTAT. The mean differences among the treatment were tested with Duncan's New Multiple Range Test (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Analysis of variance (Table 1) revealed significant variation among varieties for growth and yield contributing characters except 1000-grain weight (g) and harvest index (%). Table 1 also showed significant variation of different seedling ages on growth and yield contributing characters except plant height, 1000-grain weight. Similarly, in case of interaction between variety x seedling age from Table 1, significant variation observed for growth and yield contributing characters except plant height, non-effective tillers hill^{-1}, filled grains panicle^{-1}, unfilled grains panicle^{-1}, 100-grain weight and harvest index.

Effect of seedling age: The results of the effect of different seedling ages on various yield and yield contributing characters of transplant aman rice are shown in Table 2. Total tillers hill^{-1}, no. of effective tillers hill^{-1}, no. of non-effective tillers hill^{-1}, filled grains panicle^{-1}, unfilled grains panicle^{-1}, grain yield, straw yield and biological yield differed significantly with different seedling ages, while other characters viz., plant height, 100 -grain weight and harvest index did not differ significantly. Younger seedling (40 days) produced higher total tillers hill^{-1} (9.04) than the old (80 days) seedling. Roy and Sattar (1992) also reported similar results. The highest number of effective tillers hill^{-1} (7.72) was produced by 40 days old seedling and the older seedling produced lowest number (4.41) of effective tillers hill^{-1}. The maximum number of non-effective tillers hill^{-1} (2.46) was recorded from 80 days old seedling while the minimum number of non-effective tillers hill^{-1} (1.32) was recorded from 40 days old seedling. Young seedling produced more filled spikelets panicle^{-1} (145.13) than other

Table 1. ANOVA for growth and yield contributing characters as influenced by higher age of seedling and variety of rice at harvest

Source of variation	df	Mean squares values										
		Plant height (cm)	Total tillers hill^{-1} (no) .	Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} no.	Filled grains panicle^{-1} no.	Unfilled grains panicle^{-1} no.	1000-grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Biological yield (t/ha)	Harvest index (%)
Replication	2	10.488	2.630	1.743	0.096	9.499	9.396	0.420	0.006	0.082	0.112	0.897
Variety	2	1700.357**	24.329**	38.402**	1.690**	1524.902**	212.981**	1.461^{ns}	2.756**	2.705**	10.915**	5.927^{ns}
Error	4	8.542	0.606	0.560	0.020	28.537	5.587	0.337	0.046	0.024	0.060	2.147
Seedling age	2	15.827^{ns}	10.738**	24.658**	2.991**	641.004**	46.4.360**	0.820^{ns}	7.747**	3.940**	22.173**	69.195**
Variety x seedling age	4	3,931^{ns}	3.806**	5.463**	0.459^{ns}	13.064^{ns}	1.617^{ns}	1.839^{ns}	0.183**	0.121*	0.540**	1.702^{ns}
Error	12	6.286	0.436	0.767	0.238	8.836	6.767	1.553	0.031	0.039	0.106	0.956
CV (%)		5.00	8.25	14.46	15.07	4.18	11.56	5.20	3.97	3.24	5.08	3.34

ns = not significant, ** Significantly at 1% level of probability, * Significantly at 5% level of probability

Table 2. Effect of aged seedling and variety on the growth, yield and yield attributing characters of transplant aman rice

Treatment	Plant height (cm)	Total tillers hill^{-1} (no.)	No. effective tillers hill^{-1}	No. of non-effective tillers hill^{-1}	Filled grains panicle^{-1} (no.)	Unfilled grains panicle^{-1} (no.)	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
A. Age of seedling (days)											
40	126.36	9.04a	7.72a	1.32b	145.13a	15.02c	23.62	5.54a	6.89a	12.34a	44.10
60	125.13	8.11b	6.05b	2.06a	135.74b	23.16b	24.17	4.29b	5.78b	10.07b	42.53
80	123.71	6.86c	4.41c	2.46a	128.29c	29.34a	24.10	3.61c	5.71 b	9.32c	38.71
Level of significance	NS	**	**	**	**	**	NS	**	**	**	NS
CV (%)	5.00	8.25	14.46	15.07	4.18	11.56	5.20	3.97	3.24	5.08	3.34
B. Variety											
BRRI dhan 40	122.96b	8.27a	6.26b	2.01b	136.73b	22.68a	24.43	4.45b	6.15b	10.60b	41.81
BRRI dhan 41	139.75a	9.50a	8.02a	1.49c	149.23a	17.56b	23.78	5.01a	6.66a	11.67a	42.57
Nizersail	112.50c	6.24b	3.90c	2.35a	123.20c	27.28a	23.69	3.90c	5.57c	9.46c	40.95
Level of significance	**	**	**	**	**	**	NS	**	**	**	NS
CV (%)	5.00	8.25	14.46	15.07	4.18	11.56	5.20	3.97	3.24	5.08	3.34

Table 3. Interaction effect of variety and seedling age on the crop characters of transplant aman rice at harvest

Variety	Seedling age (days)	Plant height (com)	Total tillers hill^{-1} (no.)	No. of effective tillers hill^{-1}	No. of Non-effective tillers hill^{-1} no.	Filled grains panicle^{-1} (no.)	Unfilled grains panicle-1 (No)	1000-grain weight(g)	Grain yield (t ha-1)	Straw yield (t ha-1)	Biological yield (t ha^{-1})	Harvest index (%)
	40	124.49	9.47b	7.97b	1.50	147.68	15.08	24.42	5.27b	6.94b	12.21b	43.17
BRRI dhan40	60	124.03	8.77bc	6.45bc	2.32	136.08	23.67	24.38	4.33d	5.77d	l0.l0d	24.89
	80	120.35	6.57d	4.36d	2.21	126.42	29.30	24.48	3.73e	5.75d	9.48ef	39.40
	40	140.35	11.48a	10.89a	0.59	156.32	10.39	22.67	6.31 a	7.63a	13.94a	45.26
BRRI dhan4l	60	139.31	9.43b	8.08b	1.36	149.54	18.56	23.88	4.80c	6.29c	11.09c	43.30
	80	139.58	7.59cd	5.08cd	2.51	141.83	23.71	24.78	3.91e	6.07cd	9.98de	39.18
	40	114.24	6.17d	4.29d	1.87	131.39	19.58	23.77	4.77c	6.10cd	10.87c	43.89
Nizersail	60	112.06	6.13d	3.62d	2.51	121.59	27.25	24.26	3.73e	5.28e	9.01 fg	41.42
	80	111.20	6.43d	3.78d	2.65	116.62	35.00	23.05	3.20f	5.32e	8.51 g	37.56
CV(%)		5.00	8.25	14.46	15.07	4.18	11.56	5.20	3.97	3.24	5.08	3.34
Level of significance		NS	* *	**	NS	NS	NS	NS	**	*	**	NS

In a column figures with same letter or without letters do not differ significantly whereas figures with dissimilar letter differ significantly as per DMRT.

older seedlings. The highest number of unfilled spikelets panicle^{-1} (29.34) was recorded from 80 days old seedling while the lowest number of unfilled spikelets panicle^{-1} (15.02) from 40 days old seedling. Better performance was also observed in grain yield, straw yield and biological yield from younger seedling. These indicate that the younger seedling is genetically potential than older seedling.

Effect of variety:

The results observed that plant height, total tillers hill^{-1}, effective tillers hill^{-1}, non-effective tillers hill^{-1}, filled spikelets panicle^{-1}, unfilled spikelets panicle^{-1}, grain yield, straw yield and biological yield were significantly influenced by varieties. The highest number of plant height, total tillers hill^{-1}, effective tillers hill^{-1}, filled spikelets panicle^{-1}, grain yield, straw yield, biological yield and harvest index (%) were produced in BRRI dhan4l. But the highest number of non-effective tillers hill^{-1}, unfilled spikelets panicle^{-1} was produced in Nizersail. BRRI dhan40 produced the highest 1000-grain weight. Nizersail produced the lowest plant height, total tillers hill^{-1}, effective tillers hill^{-1}, filled spikelets panicle^{-1}, 1000-grain weight, grain yield, straw yield, biological yield and harvest index.

The highest number of non-effective tillers hill^{-1}, unfilled spikelets panicle^{-1} was produced by 80 days old seedlings. On the other hand 80 days old seedling produced the lowest number of plant height, total tillers hill^{-1}, effective tillers hill^{-1}, filled spikelets panicle^{-1}, grain yield, straw yield, biological yield, harvest index. Total tillers hill^{-1}, effective tillers hill^{-1}, non-effective tillers hill^{-1}, filled spikelets panicle^{-1}, unfilled spikelets panicle^{-1}, grain yield, straw yield, biological yield and harvest index were found in crop raised from 60 days old seedlings.

Effect of interaction:

The interaction between seedling ages and variety significantly influenced total tillers hill^{-1}, effective tillers hill^{-1}, grain yield, straw yield, biological yield. The highest plant height (140.35 cm) was obtained from BRRI dhan4l raised from 40 days old seedlings. Maximum number of total tillers hill^{-1} was obtained from BRRI dhan4l raised from 40 days old seedlings. Maximum number of filled spikelets panicle^{-1} and grain yield were obtained from BRRI dhan4l from 40 days old seedlings.

CONCLUSION

The soil and climate of Bangladesh are favorable for rice cultivation throughout the year and cropping pattern is mainly rice based. Aus, aman and boro are the rice growing seasons in Bangladesh. Among these three season, transplant aman covers about 52.46% of the total rice area and contributes to 44% of total rice production in the country (BBS, 2004). The average yield of rice in Bangladesh is around 2.36 t ha-1 (BBS, 2004), which is less than the world average (2.9 t ha-1) and significantly below the highest ranking countries (6.1 t ha-1) such as China, India, Philippines, Thailand etc. This is due to selection of appropriate variety, natural calamities, scarcity of animal power and laborers etc. The results of this study showed that the variety BRRI dhan41 is the promising one for transplant aman season in respect of grain yield. The study also showed that the 40 day old seedlings play a vital role in yield and yield contributing characters in transplant aman rice. Considering seedling ages and variety, BRRI dhan41 appeared as the promising one for transplant aman season in respect of grain yield.

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