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YIELD ABILITY OF TILLERS SEPARATED FROM T.AMAN RICE CV. BRRI DHAN41

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Abstract: The research work was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from July to December 2007 to investigate the effect of age and number of separated tiller seedlings hill^{-1} on the performance of transplant *aman* rice cv. BRRI dhan41. The experimental treatments included (A) three ages of tiller seedlings viz., 20, 30 and 40 days; (B) four different number of tiller seedlings viz., 1, 2, 3 and 4 tiller seedlings hill^{-1}. The experiment was laid out in a two-factor randomized complete block design with three replications. Both the age and number of tiller seedlings hill^{-1} had significant effect on different yield contributing characters including grain and straw yields. Grain yield was the highest due to highest number of effective tillers hill^{-1} and grains panicle^{-1} at 20-day old tiller seedlings. Straw yield also was found the highest at 20-day old tiller seedlings due to highest plant height and total tillers hill^{-1}. The lowest grain and straw yields were observed at 40-day old tiller seedlings. Grain and straw yields were highest when 2 tiller seedlings hill^{-1} were transplanted. Effective tiller hill^{-1}, grains panicle^{-1}, 1000-grain weight, plant height and total tiller hill^{-1} were lowest when 1 tiller seedling was transplanted hill^{-1}. The highest grain yield was obtained from the interaction between 20-day old tiller seedling and 3 tiller seedlings hill^{-1}. For achieving satisfactory yield 20-day old tiller seedling of BRRI dhan41 may be transplanted with 3 seedlings hill^{-1} just after recession of flood water.

Key Words: Seedling crisis, Age of tiller seedling, Number of tiller seedlings, Yield, Aman rice

Introduction

Bangladesh is a flood prone country. Crop damage due to early or late flood is very common in Bangladesh. It affects especially transplant *aman* rice, which is the main rice crop of Bangladesh and is grown during July to December in *kharif* season. But devastating flood sometimes damages this crop completely. When flood water recedes in the early or mid September, farmers try to recover their losses by transplanting late *aman* rice. During this period, seedlings of transplant *aman* rice are not available; as a result, a large area remains fallow. Sometimes, farmers use too old seedlings which results in poor yield. But, there is a option to use tillers from rice crop from the flood free land as planting material for late *aman* season as a post-flood crop. This technique of transplanting of tillers is sometimes practiced in Bangladesh (Hossain *et al.*, 1988) especially in post-flood situation (Mridha *et al.*, 1991). Age of tiller seedlings is an important determinant for the production of transplant *aman* rice when used tiller seedlings. Age of tiller seedlings may influence the tiller production, grain formation and other yield contributing characters of tiller transplanted rice crop. Biswas *et al.* (1987) found the highest grain yield by transplanting tiller seedlings, which were separated from mother plants at 35 days after transplanting. BRRI (1989) reported that tillers could be separated at 30-40 days after transplanting for retransplanting. Number of seedlings hill^{-1} is another important factor for successful rice production because it affects population unit^{-1} area. The number of tillers and their growth are greatly affected by number of seedlings hill^{-1}. Optimum number of tiller seedlings may enable the rice plant to grow properly both in its aerial and underground parts by utilizing maximum radiant energy, nutrients, space, air and water more efficiently which ultimately may lead to enhancement of yield. BRRI (1989) found that grain yield increased with the increase in the number of tiller seedlings hill^{-1} and transplantation of 2 to 5 tiller seedlings hill^{-1} performed well in respect of grain yield. Therefore, the present study was conducted to identify the suitable age and optimum number of tiller seedlings hill^{-1} for obtaining satisfactory yield from BRRI dhan41 grown as a post-flood *aman* crop.

Methods and Materials

The research work was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from July to December 2007 to investigate the effect of age and number of tiller seedlings hill^{-1} on the performance of transplant *aman* rice cv. BRRI dhan41. Geographically the experiment site is located at 24.75^0 N latitude and 90.50^{0}E longitude at a mean elevation of 18 m above the sea level. It belongs to the Old Brahmaputra Floodplain Agro-Ecolocial Zone (AEZ-9). Which falls into the non-calcareous dark grey floodplain soil? The experimental treatments included (A) three ages of tiller seedlings viz., 20, 30 and 40-day and (B) four levels of number of tiller seedlings hill^{-1} viz., 1, 2, 3 and 4 tiller seedlings hill^{-1}. The experiment was laid out in a randomized complete block design with three replications. The unit plot size was 5m^2 (2.5 m × 2.0 m) and the space between blocks and between plots were 1.0 m and 0.75 m, respectively. The land was fertilized with urea, triple super phosphate (TSP), muriate of potash (MP), gypsum and zinc sulphate @ 150, 100, 70, 60, 10 kg ha^{-1}, respectively. The entire amount of TSP, MP, gypsum and zinc sulphate was applied at final land preparation. Urea was top dressed in three equal installments at 15 days after transplanting, tillering stage and panicle initiation stage. Tillers were separated at 20, 30 and 40 days after transplanting from a previously transplanted rice crop and then transplanted in the main field according to experimental treatments on 11 September, 20 September and 30 September, 2007. All management practices were done in proper time. Five hills (excluding border hills) were randomly selected and

tagged and uprooted from each plot prior to harvest for collecting data on different crop characters. After sampling, the whole plot was harvested on 15 December 2007. The data on different agronomic characters were recorded from the randomly selected hills in each plot and those on grain and straw yields were recorded from the central $1m^2$ areas of the plot. Data were analyzed using the "Analysis of variance" technique and mean differences were recognized by Duncan's Multiple Range Test (DMRT).

Result and Discussion

Effect of Age of Tiller Seedlings

Age of tiller seedlings differed significantly in respect of number of grains panicle^{-1}, plant height, sterile spikelets panicle^{-1}, grain yield, straw yield, harvest index (Table-1). Results represent that 20 days old tiller seedling produced highest number of grains panicle^{-1}(122.7) and the lowest one (102.8) was obtained from 40 days old tiller seedlings. This result are in conformity with those of Singh *et al* (1999) who reported that grains panicle^{-1} varied with age of tiller seedlings. The highest number of effective tillers hill^{-1} (10.02) was observed in 20-day old tiller seedlings and the lowest one (6.45) was produced by 40-day old tiller seedlings. This result indicates that younger tillers had a tendency to produce number effective tillers hill^{-1} than older ones. Anwar and Begum (2004) also opined in the same tune. The 1000-grain weight was not significantly affected but ranged from 24.83 to 25.13. However, apparently highest weight (25.13g) of 1000 grains was recorded in 20-day old tiller seedlings and the lowest one (24.83 g) was obtained from 40-day old tiller seedlings. These results are also in agreement with those of Roy *et al*. (1989). It is conspicuous that the highest grain yield (4.19 t ha^{-1}) was obtained when 20-day old tiller seedlings were transplanted and the lowest one (2.37 t ha^{-1}) was found when 40-day old tiller seedlings were transplanted. The crop raised from 40-day old tiller seedlings received less time for their growth, development and filling of grains and got unfavourable climatic condition which resulted in the reduced grain yield. On the other hand, 20-day old tiller seedlings received relatively more time for their growth, development, grain filling, and resulted in the increased number of productive tillers hill^{-1} and grains panicle^{-1} which produced the highest grain yield. Mollah *et al.* (1992) also reported similar findings and observed that tiller separation at 40 days after transplanting significantly reduced grain yield compared to separation at 30 DAT. Grain yield and other yield contributing characters were the highest at 20-day old seedlings which is also reported by Abu (2002). Anwar and Begum (2004) studied the tolerance of hybrid rice variety Sonarbangla 1 to tiller separation and reported that time of tiller separation significantly influenced plant height, total number of tillers hill^{-1}, number of bearing tillers hill^{-1} and panicle length but not grain and straw yields. The highest straw yield (5.66 t ha^{-1}) was produced by 20-day old tiller seedling and the lowest one (2.93 t ha^{-1}) was found in 40-day old tiller seedlings. The highest straw yield was the outcome of its longest plant (119.3) and maximum number of total tillers hill^{-1}(13.03). The result also indicates that straw yield was decreased with increasing tiller age.

Effect of number of tiller seedling hill^{-1}

Number of tiller seedlings hill^{-1} exerted significant effect on different yield contributing characters including straw yields of BRRI dhan41. Yield enhancing characters like effective tillers hill^{-1} (9.08) and grains panicle^{-1} (118.8) were found the highest at 3 tiller seedlings hill^{-1}. Grain yield and other parameters recorded with 3 tiller seedlings hill^{-1} were statistically similar to 2 tiller seedlings hill^{-1}. It was observed that the highest number of total tillers hill^{-1} (11.87) was produced when 3 tiller seedlings hill^{-1} were used which was as good as transplanting of 2 tiller seedlings hill^{-1}. The lowest number of total tillers (9.16) was produced when just 1 tiller seedling hill^{-1} was transplanted. It was observed that the number of total tillers hill^{-1} increased significantly as the number of tiller seedling hill^{-1} increased. The highest number of effective tillers hill^{-1} (9.089) was produced by 3 tiller seedlings hill^{-1} and the lowest one (7.022) was recorded with 1 tiller seedling hill^{-1}. It was observed that increase in number of tiller seedlings hill^{-1} increased the number of effective tiller hill^{-1}. Shrirame *et al.* (2002) observed that 2 tiller seedlings hill^{-1} gave significantly higher number of effective tillers hill^{-1} than one tiller seedling hill^{-1}. The highest number of grains panicle^{-1} (118.8) was recorded in 3 tiller seedlings hill^{-1} which was identically followed by 2 tiller seedlings hill^{-1}, the lowest one (107.0) was recorded from 1 tiller seedling hill^{-1}. The results are in agreement with that of Biswas and Salokhe (2001) who found significant increase in number of grains panicle^{-1} of rice by the increasing number of tiller seedlings hill^{-1}. The effect of number of tiller seedlings hill^{-1} was found to be insignificant for 1000-grain weight. However, numerically the maximum 1000-grain weight (25.02g) was recorded in 2 tiller seedlings hill^{-1} while the lowest one (24.81g) was observed in 1 tiller seedling hill^{-1}. Grain yield ranged from 2.80 to 3.77 t ha^{-1} and the highest value (3.77 t ha^{-1}) was obtained from 2 tiller seedlings hill^{-1}, which was as good as 2 tiller seedlings hill^{-1} regarding grain yield. The lowest grain yield (2.80 t ha^{-1}) was recorded when 1 tiller seedling hill^{-1} was transplanted. Improvement of yield components e.g. number of effective tillers hill^{-1} and number of grains panicle^{-1} were mainly responsible for increased grain yield in 2-3 tiller used hill^{-1}. On the other hand, 1 tiller hill^{-1} failed to produce satisfactory yield because of lowest number of effective tiller hill^{-1} and number of grains panicle^{-1}. The results are similar to the findings of Asif *et al.* (1997) who reported that 2 tiller seedlings hill^{-1} performed better than 1 tiller seedling hill^{-1}. BRRI (1990) also reported that transplantation of 2-3 tiller seedlings hill^{-1} performed the best regarding grain yield. Biswas *et al.* (1987) also recorded the highest

grain yield from 2-3 tiller seedlings hill^{-1}. The highest straw yield (4.72 tha^{-1}) was produced by 2 tiller seedlings hill^{-1} which was identically followed by 3 tiller seedlings hill^{-1} (4.52 t ha^{-1}). The lowest one (4.00) was observed in 1 tiller seedling hill^{-1}. It was observed that straw yield was increased with increasing the number of tiller seedling hill^{-1}.

Effect of Interaction

Interaction between age and number of tiller seedlings hill^{-1} had significant effect on grain yield. Results presented in Table 3 showed that the highest number of effective tillers hill^{-1} (11.33) was produced with 20-day old tiller seedlings transplanted @ 2 tiller seedlings hill^{-1} which was statistically identical with 20-day old tiller seedlings transplanted @ 2 tiller seedlings hill^{-1}. The lowest number of effective tillers (5.86) hill^{-1} was found when 40-day old tiller seedlings were transplanted @ 1 tiller seedling hill^{-1}. Results clearly indicate that younger tillers coupled with increased number of tiller hill^{-1} gave more effective tillers. These findings corroborate with those reported by Hossain (1999) who stated that effective tillers hill^{-1} varied with age and number of tiller seedlings hill^{-1}. Results presented in Table 3 showed that the highest number of grains panicle^{-1} (129.3) was achieved when 20-day old seedlings were transplanted @ 3 tiller seedlings hill^{-1} which was statistically identical with the interaction between 20-day old tiller seedlings and 2 tiller seedlings hill^{-1}. The lowest number of grains panicle^{-1} (97.35) was recorded in 40-day old tiller seedlings transplanted with 1 tiller seedling hill^{-1} which was identically followed by the interaction of 40-day old seedlings × 4 tiller seedlings hill^{-1}. Interaction between age and number of tiller seedling hill^{-1} was found insignificant in respect of 1000-grain weight which ranged from 24.60 to 25.36, From table 3 it is evident that the highest grain yield (4.53 t ha^{-1}) was produced by the interaction of 20-day old tiller seedlings × 3 tiller seedlings hill^{-1} which was statistically at par with the treatment combination of 20-day old tiller seedlings × 2 tiller hill^{-1} and 20-day old tiller seedlings × 4 tiller seedlings hill^{-1}. The lowest one (1.91 t ha^{-1}) was recorded in 40-day old tiller seedlings transplanted @ 1 tiller seedling hill^{-1}. Interaction effect between age and number of tiller seedling hill^{-1} exerted no significant influence on straw yield which ranged from 2.41 t ha^{-1} to 6.00 t ha^{-1}. However, apparently the highest straw yield (6.00 t ha^{-1}) was recorded from the interaction of 20-day old seedlings × 3 tiller seedlings hill^{-1} and the lowest one (2.41 t ha^{-1}) was recorded with 40-day old tiller seedlings × 1 tiller seedling hill^{-1}.

From the present study, it can be concluded that tiller separation followed by transplanting can be practiced as a promising technology in flood prone areas of Bangladesh to recover the yield loss of transplant *aman* rice to some extent as a crop rehabilitation measure. For achieving higher yield 20-day old tiller seedling of BRRI dhan41 may be transplanted with 2-4 seedlings hill^{-1} just after recession of flood water.

Table 1 Effect of age of tiller seedlings on the performance of BRRI dhan 41

Age of tiller seedling (days)	Plant height (cm)	Total tillers hill^{-1} (no.)	Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} (no.)	Grains panicale^{-1} (no)	1000 grains weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
20	119.3a	13.03a	10.02a	3.01a	122.7a	25.13	4.19a	5.66a	42.24b
30	107.9b	11.22b	8.33b	2.88b	117.4b	24.83	3.75b	4.58b	45.33a
40	91.20c	8.22c	6445c	1.76b	102.8c	24.87	2.37c	2.93c	44.55a
Level of significance	0.01	0.05	0.01	0.01	0.01	NS	0.01	0.01	0.01
CV (%)	3.00	3.17	3.06	5.01	2.66	2.97	4.47	7.28	4.03

Table 2 Effect of number of tiller seedlings hill^{-1} on the performance of BRRI dhan 41

Tiller seedling hill^{-1} (no.)	Plant height (cm)	Total tillers hill^{-1} (no)	Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} (no.)	Grains panicle^{-1} (no.)	Weight of 1000 grains (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
1	102.7b	9.16c	7.022d	2.133b	107.0c	24.81	2.80c	4.00c	41.78b
2	107.2a	11.78a	8.822b	2.956a	11.7.2a	25.02	3.77a	4.72a	44.66a
3	107.5a	11.87a	9.089a	2.778a	118.8a	24.99	3.67a	4.52ab	44.54a
4	107.1a	10.49b	8.133c	2.356b	114.2b	24.96	3.50b	4.33b	45.18a
Level of significance	0.05	0.01	0.05	0.01	0.01	NS	0.01	0.01	0.01
CV (%)	3.00	3.17	3.06	5.01	2.66	2.97	4.47	7.28	4.03

Table 3 Effect of interaction of age and number of tiller hill^{-1} on the performance of BRRI dhan41

Interaction (Age× no. of tiller seedling hill^{-1})	Plant height (cm)	Total tillers hill^{-1} (no)	Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} (no.)	Grains panicle^{-1} (no.)	1000 grains weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
A_1T_1	116.3a	10.40e	7.733ef	2. 67	113.0de	24.80	3.41c	5.25	39.40ef
A_1T_2	120.7a	14.00b	10.93a	3.07	125.0ab	25.10	4.41a	5.83	43.07cd
A_1T_3	120.7a	14.67a	11.33a	3.33	129.3a	25.63	4.53a	6.00	42.33de
A_1T_4	119.3a	13.07c	10.07b	3.00	123.3d	25.00	4.41a	5.58	44.17abcd
A_2T_1	105.0b	10.07ef	7.467f	2.60	110.3ef	24.80	3.08de	4.33	41.57de
A_2T_2	108.7b	11.80d	8.533d	3.26	119.7bc	25.07	4.00b	4.91	44.83abcd
A_2T_3	110.7b	12.40d	9.267c	3.13	122.7b	24.60	4.08b	4.50	47.53a
A_2T_4	107.3b	10.60e	8.067e	2.53	117.0cd	24.87	3.83b	4.58	47.37ab
A_3T_1	86.83d	7.00i	5.867i	1.13	97.53h	24.83	1.91g	2.41	44.37abcd
A_3T_2	92.20cd	9.53f	7.000g	2.53	107.0fg	24.90	2.91e	3.41	46.07abc
A_3T_3	91.20cd	8.53g	6.667gh	1.87	104.3g	24.73	2.41f	3.08	43.77cd
A_3T_4	94.57c	7.80h	6.267hi	1.53	102.4gh	25.00	2.25f	2.83	44.00bcd
Level of significance	0.05	0.05	0.05	NS	0.01	NS	0.01	NS	0.01
CV (%)	3.00	3.17	3.06	5.01	2.66	2.97	4.47	7.28	4.03

In a column, figures having similar letter(s) do not differ significantly whereas the figures with dissimilar letter(s) differ significantly as adjusted by DMRT; NS Indicates Not Significant

A_1 = 20 Days old tiller seedling, T_1= 1 tiller seedling hill^{-1}, A_2 = 30 Days old tiller seedling, T_2 = 2 tiller seedlings hill^{-1},A_3 = 40Days old tiller seedling, T_3 = 3 tiller seedlings hill^{-1},T_4 = 4 tiller seedlings hill^{-1}

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