Effect of variety and weeding on the yield of transplant aman rice

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Abstract: An experiment was undertaken at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh in 2002 transplant aman season to examine the effect of variety and weeding on the yield of transplanting aman rice. Effects were evaluated on three varieties viz. BR11, BRRI dhan39 and Nizersail and five weeding treatments viz. no weeding, at 20 and 40 days after transplanting (DAT), weeding at 30 and 50 DAT, weeding at 40 and 60 DAT and weed free. The effect of weeding treatments on weed density and weed dry weight was significant. Among the varieties, BR11 produced the highest grain yield (5.35 t ha^{-1}) and Nizersail yielded the lowest. Modern variety BR11 produced the highest straw yield which was greater than the other varieties. Among the weeding treatments, weed free treatment showed the best performance. The next best was weeding at 20 and 40 DAT which produced grain and straw yields similar to those from weeding at 30 and 50 DAT.

Key words: Variety, Weeding, Yield, T. aman rice

Introduction

In Bangladesh, rice cultivation covers about 79% of the total cropped area of Bangladesh (BRRI, 1998) of which transplant aman rice covers about 58.78% to the total rice production (BBS, 1998). But the yield of rice here is much lower than that of the other rice growing countries of the world. Weeds are present on every crop land in the world. So, it is often mentioned, "agriculture is a fight against weed" (Mukhopadhyay and Ghose, 1994). The infestation of weed is one of the important constraints in the cultivation of crop (Gaffer, 1983; Mamun, 1988). The prevailing climatic and edaphic factors are highly favorable for luxuriant growth of numerous species of weeds, which offer a keen competition with rice crop in Bangladesh (Mamun, 1988). Many investigators have reported great losses in the yield of rice due to weed infestation in different parts of the world (Nandal and Singh, 1994). Mamun (1990) reported that weed growth reduced grain yields by 68-100% for direct seeded aus rice, 16-48% for aman rice and 22-36% for modern boro rice. According to Smith and Shaw (1968), weed depressed the number of grains $panicle^{-1}$ and grain weight. Competition between rice and weed is generally influenced by the season in which the crop is grown, the weed species present and their habit, and the growth rate and density of both the crop and the weed. Therefore, a detailed ecological study on crop-weed interaction is fundamental to enhance the success of weed control methods. Furthermore, the knowledge of weeds, their distribution, composition, and interaction with the agro-ecological zones and associated crop and crop management practice are indispensable for improving the existing methods or developing new methods of weed control to achieve optimum weed management with minimum energy and cost. Rice varieties have tremendous impact or the growth and infestation of weeds in the field. Usually, short varieties face more weed infestation than the taller ones (Sarker, 1979). In order to reduce weed competition and get maximum yield of rice, appropriate variety should be selected. Hence, the best variety and method of weeding need to be found out with a view to reducing losses due to weed infestation and getting maximum yield. Therefore, the present experiment was undertaken to study the performance of variety and regime on the performance of transplant aman rice.

Methods and Materials

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from July 2002 to December 2002 with a view to evaluating the effect of variety and weeding on the yield of transplant aman rice. The experiment included three varieties, namely BR11, BRRI dhan39 and Nizersail, and five weeding treatments, namely, no weeding (W_1), weeding at 20 and 40 DAT (W_2), weeding at 30 and 50 DAT (W_3), weeding at 40 and 60 DAT (W_4) and weeding free (W_5). The experimental field was a medium high land belonging to non-calcareous dark grey floodplain soil under the Old Brahmaputra Floodplain Agro-ecological Zone (AEZ-9). The experiment was laid out in a split-plot design with three replications in which varieties were assigned of the main plots and weeding treatments to the subplots (unit plots). There were 45 plots in the experiment and the size of the unit plot was 4.0 m × 2.5 m. Distance between replications was 1.0 m and that between main plots or between subplots was 0.75 m. The land was well prepared and fertilized with urea, triple super phosphate (TSP), muriate of potash (MP), gypsum and zinc sulphate as per BRRI recommendations. The entire amount of TSP, MP, gypsum, zinc sulphate and one-third of urea was applied at the time of final land preparation. The rest of two-third urea was top-dressed in two equal splits at 30 and 45 DAT. Seedlings were uprooted carefully from the nursery bed at thirty days after sowing. Uprooted seedlings were transplanted in the unit plots on 4 August, 2002 at the rate of three seedlings hill^{-1} maintaining a spacing of 25 cm from row to row and 15 cm from hill to hill. Ten hills (excluding border hills) were randomly selected and uprooted from each plot prior to harvest for recording data on yield components. An area of 1 m^2 was selected in the middle portion of each plot to record the yield of grain and straw. Then data were recorded on total weed population, total weed dry weight**,** no. of effective tillers hill^{-1}, no. of filled grains panicle^{-1} and 1000- grain weight. All the data were statistically analyzed by MSTAT and mean differences were adjudged by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Weed Parameters

Effect of variety

Mean squares of weed populations at 30 and 50 days after transplanting (DAT) show that these were significantly affected by variety. Weed population m^{-2} as affected by variety has been presented in Table 1. The highest weed population of 109.08 at 30 DAT and 107.02 at 50 DAT were found in BR11 which were statistically identical with BRRI dhan39 (107.75 at 30 DAT and 107.01 at 50 DAT). This shows that the highest weed population was found with the shortest variety BR11 and the lowest with the tallest variety Nizersail. This observation is in agreement with the findings of Sarker (1979) who reported that tall varieties produced lower weed population than the dwarf varieties.

Significant variation was found due to variety in total weed dry weight m^{-2} at 30 and 50 DAT. At 30 DAT, the highest total weed dry weight was found to be 42.10g in BR11 which was statistically identical with BRRI dhan39. The lowest dry weight 30.10g was found in Nizersail (Table 1) because it is tall variety. At 50 DAT, the highest total weed dry weight was found to be 41.29g in BR11 which was statistically identical with BRRI dhan39. The lowest dry weight 29.45g was found in Nizersail. It was evident that the highest weed dry weight m^{-2} was observed in semi dwarf variety BR11 and the lowest was observed in the tall variety Nizersail. This observation is in agreement with the results reported by Sarker (1979).

Effect of Weeding

Weed populations m^{-2} at 30 and 50 DAT were significantly influenced by weeding. At 30 DAT, the highest weed population (126.83) was found in no weeding and the lowest (0.00) in weed free treatment. At 50 DAT, the highest weed population (123.26) was found in no weeding treatment, which was statistically identical with W_4 treatment (weeding at 40 and 60 DAT) and the lowest one (0.00) was found in W_5 (weed free) treatment (Table 2).

There was significant effect on total weed dry weight m^{-2} due to weeding at 30 and 50 DAT. At 30 DAT, the highest total weed dry weight m^{-2} (49.26g) was obtained in W_1 (no weeding) treatment which was statistically identical with W_3 treatment (weeding at 30 and 50 DAT) and the lowest total weed dry weight m^{-2} (0.00g) was found in W_5 (weed free) treatment. At 50 DAT, the highest total weed dry weight m^{-2} (47.63g) was obtained in W_1 (no weeding) treatment which was statistically identical with W_3 and W_4 treatment and the lowest (0.00g) was found in W_5 (weed free) treatment (Table 2).

Table 1. Effect of variety on weed population and weed dry weight at 30 and 50 DAT of T. aman rice

Variety	Weed population (no./ m^2)		Weed dry weight (g)	
	30 DAT	50 DAT	30 DAT	50 DAT
BR 11	109.08 a	107.02 a	42.10 a	41.29 a
BRRI dhan39	108.75 a	107.01 a	41.53 a	40.47 a
Nizersail	75.75 b	74.53 b	30.10 b	29.45 b
$S\bar{x}$	1.921	1.312	0.653	0.455
P> 0.01	**	**	**	**

Table 2. Effect of weeding on weed population and weed dry weight at 30 and 50 DAT of T. aman rice

Weeding	Weed population (no./ m^2)		Weed dry weight (g)	
	30 DAT	50 DAT	30 DAT	50 DAT
W_1	126.83 a	123.26 a	49.26 a	47.63 a
W_2	118.60 b	116.80 b	45.84 b	44.42 b
W_3	121.29 ab	119.58 ab	47.09 ab	46.01 ab
W_4	122.58 ab	121.28 a	47.36 ab	47.30 a
W_5	0.00 c	0.00 c	0.00 c	0.00 c
$S\bar{x}$	2.102	1.288	0.987	0.816

P> 0.01	**	**	**	**

Effect of Interaction between Variety and Weeding

The interaction between variety and weeding had significant effect on total weed population m^{-2} at 30 and 50 DAT. At 30 DAT, the highest weed population (141.31) was found in V_1W_1 treatment (BR11 x no weeding) and the lowest one (0.00) was found in V_1W_5 (BR11 x weed free), V_2W_5 (BRRI dhan39 x weed free), V_3W_5 (Nizersail x weed free). At 50 DAT, the highest weed population (137.27) was found in V_1W_1 (BR11 x no weeding) treatment and the lowest one (0.00) was found in V_1W_5 (BR11 x weed free), V_2W_5 (BRRI dhan39 x weed free) and V_3W_5 (Nizersail x weed free) treatments (Table 3).

The interaction between variety and weeding had significant effect on total weed dry weight m^{-2} at 30 and 50 DAT. At 30 DAT, the highest weed dry weight (54.01g) was found in V_1W_1 treatment (BR11 x no weeding) and the lowest one (0.00g) was found in V_1W_5 (BR11 x weed free), V_2W_5 (BRRI dhan39 x weed free) and V_3W_5 (Nizersail x weed free) treatments. At 50 DAT, the highest weed dry weight (53.11g) was found in V_1W_1 (BR11 x weed free) treatment and the lowest (0.00g) was found in V_1W_5 (BR11 x weed free), V_2W_5 (BRRI dhan39 x weed free) and V_3W_5 (Nizersail x weed free) treatments (Table 3).

Table 3. Interaction effect of variety and weeding on weed population and weed dry weight at 30 and 50 DAT of T. aman rice

Variety × Weeding	Weed population (no. m^2) at		Weed dry weight (g) at	
	30 DAT	50 DAT	30 DAT	50 DAT
V_1W_1	141.31 a	137.27 a	54.01 a	52.11 ab
V_1W_2	132.17 a	129.98 b	50.80 a	49.02 ab
V_1W_3	135.81 a	133.72 ab	52.71 a	52.22 ab
V_1W_4	136.13 a	134.91 ab	52.98 a	53.11 a
V_1W_5	0.00 c	0.00 d	0.00 c	0.00 d
V_2W_1	141.03 a	137.19 a	53.89 a	52.04 ab
V_2W_2	131.28 a	131.02 ab	50.11 a	48.22 b
V_2W_3	134.91 a	131.81 ab	51.66 a	50.00 ab
V_2W_4	136.53 a	135.01 ab	51.99 a	52.11 ab
V_2W_5	0.00 c	0.00 d	0.00 c	0.00 d
V_3W_1	98.16 b	95.31 c	39.88 b	38.75 c
V_3W_2	92.35 b	90.19 c	36.61 b	36.01 c
V_3W_3	93.15 b	93.22 c	36.91 b	35.80 c
V_3W_4	95.08 b	93.91 c	37.10 b	36.69 c
V_3W_5	0.00 c	0.00 d	0.00 c	0.00 d
S $\overline{X}$	3.640	2.231	1.709	1.414
P>0.01	**	**	**	**

W_1 = No weeding; W_2 = Weeding at 20 and 40 DAT; W_3 = Weeding at 30 and 50 DAT; W_4 = Weeding at 40 and 60 DAT; W_5 = Weed free. V_1= BR 11; V_2 = BRRI dhan39; V_3 = Nizersail

Yield performance

Effect of variety

Variety differed significantly among them for grain yield. The highest grain yield (5.35 t ha^{-1}) was produced by BR11 followed in order by BRRI dhan39 (4.80 t ha^{-1}) and Nizersail (3.34 t ha^{-1}) (Table 4). Yield increasing parameters such as no. of effective tillers $hill^{-1}$ (10.17), no. of grains panicle^{-1} (85.22) and 1000- grain weight (23.02 g) were highest in BR11 which ultimately increased the grain yield. On the other hand, reduction of no. of effective tillers hill^{-1}, no. of grains panicle^{-1} and 1000- grain weight in BRRI dhan39 and Nizersail caused a reduction in the grain yield of transplanted aman rice.

Effect of weeding

Grain yield of transplant aman rice was significantly influenced by weeding (Table 5). The highest grain yield (5.41 t ha^{-1}) was obtained from the weed free condition. Weeds competed with the crop for nutrition, water, air, sunlight and space which resulted in reduced yield. Effective weed management enhanced production of effective tillers hill^{-1}, no. of grains panicle^{-1} and 1000- grain weight which ultimately increased grain yield of rice. On the other hand, reduction of no. of effective tillers hill^{-1} and no. of grains panicle^{-1} due to severe weed competition in no weeding treatment caused a reduction in the grain yield of transplant aman rice (Table 5). Therefore, rice should be kept weed free as much as possible throughout its life cycle to obtain good yield. Similar results were also reported elsewhere (Alam *et al.*, 1995).

Table 4. Effect of variety on the yield attributes and yield of transplant aman rice

Variety	No. of effective tillers hill^{-1}	No. of grains panicle^{-1}	1000- grain weight (g)	Grain yield (t ha^{-1})
BR 11	10.17 a	85.22 a	23.02 a	5.35 a
BRRI dhan39	8.45 b	78.23 b	22.27 a	4.80 b
Nizersail	7.75 c	76.99 c	16.62 b	3.34 c
$S\bar{x}$	0.110	1.147	0.304	0.074
P>0.01/0.05	**	*	**	**

Table 5. Effect of weeding on the yield attributes and yield of transplant aman rice

Variety	No. of effective tillers hill^{-1}	No. of grains panicle^{-1}	1000- grain weight (g)	Grain yield (t ha^{-1})
W_1	7.24 c	70.04 d	20.18	3.59 d
W_2	9.04 b	83.12 b	20.97	4.69 b
W_3	8.80 b	80.05 bc	20.58	4.51 bc
W_4	8.45 b	77.14 c	20.48	4.28 c
W_5	10.42 a	90.40 a	20.97	5.41 a
$S\bar{x}$	0.191	1.077	0.296	0.110
P>0.01/0.05	**	*	NS	**

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

The results of the present study suggest that the variety BR11 is superior to BRRI dhan39 and Nizersail for grain yield, the tall variety Nizersail can suppress weeds better than the semi dwarf varieties and that transplant aman rice should be grown in weed free condition i.e. weeding at 20 and 40 DAT or weeding at 30 and 50 DAT for securing good yields.

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