J. Agrofor. Environ. 3 (1): 143-146, 2009 ISSN 1995-6983

Effect of herbicide on three mordern varieties of transplant *Aus* rice

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Abstract: An experiment was conducted at the Agronomy Field Laboratory of Bangladesh Agricultural University, Mymensingh during the period from April to August 2007 to assess the effect of different herbicides on three modern transplant *aus* rice varieties. The experiment comprised two factors, (1) three varieties of *aus* rice viz. BR3, BR14 and BR26 and (2) five weeding treatments such as three herbicides viz. Fastmix EW (Butachlor 50%), Comit 500 EC (Pretilachlor), Sunrise 150 WG (Ethoxysulfuron) complete weed free and control (no weeding). Among the eleven weed species belonging to eight families, Panikachu *(Monochoria hastata),* Chechra *(Scierpur juncoides),* Shama *(Echinochloa crusgalli),* Shusni shak *(Marsilea crenala),* Matichech *(Cyperus iria)* and Panilong *(Ludwigia hyssopifolia)* were most important. Among the rice varieties, the highest grain yield (2.57 t ha^{-1}) and straw yield (3.51 t ha^{-1}) were found in BR3 variety. The highest number of non-effective tillers $hill^{-1}$ (6.59), sterile spikelets $panicle^{-1}$ (30.90) and the lowest effective tillers $hill^{-1}$ (6.72), grain yield (1.88 t ha^{-1}), straw yield (2.98 t ha^{-1}) and harvest index (38.68%) were produced by BR26 variety. Among the herbicides, Sunrice 150 WG @ 100 g ha^{-1} showed the best performance. The highest grain yield (3.65 t ha^{-1}) and harvest index (46.20%) were found in combination of BR3 (V_1) and weed free (H_{00}) treatment. The second highest filled spikelets $panicle^{-1}$ (82.55) and grain yield (2.73 t ha^{-1}) were found in combination of BR3 (V_1) and Sunrice 150WG (H_3) treatment.
Key Words: Herbicide, Grain yield and Transplant *aus* Rice

Introduction

Rice *(Oryza sativa.)* is one of the most extensively cultivated cereals of the world and contains 6.36-8.13% protein. It is the principal food crop of Bangladesh and constitutes 95% of food grain production in this country. The total area and production of rice in the year 2006 were 6.46 million hectares and 11.25 million metric tons, respectively, the total area and production of *aus* rice were 1.03 million hectares and 1.13 million metric tons, respectively (BBS, 2006). The climate as well as the edaphic condition of Bangladesh is favourable for the growth of numerous noxious weed species. Weed growth reduced the grain yield by 68- 100% for direct seeded *aus* rice, 60.29% for deep water broadcast Aman rice, 45% for transplant Aman rice and 22.36% for modem Boro rice (Mamun, 1990). The important factor for low yield and quality of rice is poor management depending on the type of weed flora and their intensity. Weed infestation is more in *aus* rice in Bangladesh.

The farmers generally practice preparatory land tillage and practice conventional method of weeding i.e. hand weeding. This method of weed control is time consuming, laborious and costly. Moreover, in Bangladesh during rice season, uprooting of weeds at critical period is difficult due to unfavourable weather and peak labour demand. In this case, herbicides are the promising alternative in controlling weeds. On the other hand, herbicides are used successfully for weed control in rice fields for rapid effect, easier application and low cost involvement in comparison to the traditional method of hand weeding (De Datta, 1980). In the recent years the use of herbicides in crop production has brought a revolution in the field of weed control in the developed countries. The chemical methods of weed control are gaining popularity all over the world for its miraculous results in crop production but most of the herbicides are very new in our country. The available used herbicides in controlling weeds in rice field are of overseas origin. We depend on the foreign multinational companies which supply the herbicides but not the same brand for long time. So, continuous evaluation is necessary for benefit of the farmers. The present study was, therefore, undertaken to find out the effect of different herbicides (Comit, Fastmix and Sunrice) on yield and yield components in three modem varieties of Transplant *aus* rice (BR3, BR14 and BR26).

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory of Bangladesh Agricultural University (BAU), Mymensingh during the period from April to August 2007. Two sets of treatments were include viz. three T. *aus* rice varieties- BR3 (V_1), BR14 (V_2) and BR26 (V_3) and five weeding treatments viz. Fastmix EW (Butachlor 50%) @, 2 Lha^{-1} (H_1), Comit 500 EC (Pretilachlor) @ 1 L ha^{-1} (H_2), Sunrice 150 WG (Ethoxysulfuron) @ 100 g ha^{-1} (H_3) complete weed free (Hoo) and control (no weeding) (Ho). The experiment was laid out in a randomized complete block design (RCBD) with three replications. Plot to plot and block to block distance were 0.25m and 0.5 m, respectively. The unit plot size was 4.0 m x 2.5 m. Seeds of *aus* rice were collected from Agronomy Field Laboratory, BAU, Mymensingh. The fertilizers namely Urea, Tripple Super Phosphate (TSP), Muriate of Potash (MP), Gypsum and Zinc Sulphate were applied to the plot @ 135, 100, 70, 60 and 10 kg ha^{-1}.

The whole amount of TSP, MP, Gypsum, Zinc Sulphate and $1/3^{rd}$ of Urea were applied as basal doses in the plot at the time of final land preparation. The rest of Urea was top dressed in two equal splits at 22 DAT and 45 DAT. Thirty days old seedlings were uprooted carefully from the nursery on 10 May 2007 and transplanted in the main field in the same day. Two seedlings $hill^{-1}$ were transplanted with a spacing of 10 cm x 15 cm. Herbicides were applied at 4 days after transplanting (DAT) at recommended dose in presence of 2-5 cm standing water and no other weeding operation was done till harvest of the crop. Five hills (excluding border hills) were randomly selected and tagged and uprooted from each plot prior to harvest for collecting data on different yield and yield components. After sampling, each plot was harvested at maturity on different dates according to variety. The collected data were compiled and analyzed statistically using the ANOVA and the mean differences were adjudged by Duncun's Multiple Range Test (DMRT).

Results and Discussion

Effect of variety: The effect of variety was significantly in respect to plant character and all the yield and yield contributing characters at harvested (Table 1). The highest grain yield (2.57 t ha^{-1}) was observed in BR3 (V_1) variety. The highest number of effective tiller $hill^{-1}$ (8.07) and number of filled spikelets $panicle^{-1}$ (72.25) were observed in BR3 (V_1) variety which resulted in the highest grain yield. BRRI (l992) reported that the number of filled spikelets $panicle^{-1}$ was influenced significantly due to variety. The lowest grain yield (1.88 t ha^{-1}) was achieved from BR 26 (V_3) which might be due to lowest number of effective tillers $hill^{-1}$ (6.72), lowest number of filled spikelets $panicle^{-1}$ (52.33), more number of non-effective tillers $hill^{-1}$ (5.59) and more number of sterile spikelets $panical^{-1}$ (30.90). The highest straw yield (3.51 t ha^{-1}) was observed at BR3 (V_1) variety which may be due to highest number of total tillers $hill^{-1}$ (12.54). The lowest straw yield (2.98 t ha^{-1}) was also observed in BR26 (V_3) variety. Similar result was also reported by the findings of Chowdhury *et al.* (1995) who reported a variable straw yield existed among the varieties. The highest weight of 1000-grain (30.40 g) and harvest index (43.37 %) were obtained from BR14 while the lowest weight of 1000-grain (21.33 g) and harvest index (38.68 %) were obtained from BR26 which was statistically different to the BR3 (Table 1). These differences might have occurred due to variations of genetic makeup among the varieties.

Table 1. Effect of variety on yield and yield components of T. *aus* rice

Variety	Total tillers $hill^{-1}$	No. of effective tillers $hill^{-1}$	No. of non-effective tillers $hill^{-1}$	Filled spikelets $panicle^{-1}$	Sterile spikelets $panicle^{-1}$	1000- grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest Index (%)
V_1 (BR3)	12.54 a	8.07a	4.44 b	72.25 a	19.83 b	25.67 b	2.57 a	3.51 a	42.27 b
V_2 (BR14)	10.94 b	6.96 b	3.98 c	69.16 b	14.52 c	30.40 a	2.42 a	3.02 b	43.37 a
V_3 (BR26)	12.30 a	6.72 c	5.59 a	52.33 c	30.90 a	21.33 c	1.88 b	2.98 b	38.68 c
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Figures in a column having common letter (s) do not differ significantly at 1% level of probability as per DMRT

Effect of weed control treatment: The effect of different weeding treatments were significant for all the growth, yield and yield contributing character (Table 2). The experimental data indicated that the complete weed free (Hoo) treatment showed its superiority over herbicide application and herbicidal treatments showed their superiority over control (H_0) treatment. The significantly highest grain yield (2.58 t ha^{-1}) was observed in Sunrice 150 WG@ 100 g ha^{-1} (H_3) treatment. Sunrice 150 WG@ 100 g ha^{-1} (H_3) produced highest number of effective tillers $hill^{-1}$ (8.08) and filled spikelets $panicle^{-1}$ (73.09) which resulted in the highest grain yield and harvest index (42.46%). Similar result was reported by Rekba *et al.* (2003). The lowest grain yield (1.62 t ha^{-1}) was found in control (Ho) treatment. This findings is in close agreement with the finding of Bhawmick and Ghosh (2002) who found Ethoxysulfuron 150 WG as post emergence effectively kept most of the sedges and broad leaf weeds under control and improved the grain yield. Yield retarding characters like non-effective tillers $hill^{-1}$ (4.73) was found highest in Fastmix EW @ 2 L ha^{-1} (H_1) treatment which was statistically similar with Sunrice 150 WG @ 100 g ha^{-1} (H_3) and Comit 500 EC @ 1 L ha^{-1} (H_2). The lowest number of non-effective tiller $hill^{-1}$ (4.13) was found in weed free (Hoo) treatment. Such results were found which might be due to higher weed infestation and phytotoxic effects of herbicides on rice plant. Number of sterile spikelets $panicle^{-1}$ (24.63) was highest in control (Ho) treatment. The lowest sterile spikelets $panicle^{-1}$ (18.67) was found in weed free (H_{00}) treatment which was identical with all other treatments (Table 2). The second highest straw yield (3.46 tha^{-1}) was found in Sunrice 150 WG @ 100 g ha^{-1} (H_3) treatment which may be due to highest total tillers $hill^{-1}$ (12.76). The lowest straw yield (2.54 t ha^{-1}) was found in control (Ho) treatment and it might be due to severe competition of weeds with crop plants which depressed the, total number of tillers $hill^{-1}$ and finally the yield of straw. The highest weight of 1000 grain (26.43 g) and harvest index (43.92%) were found in weed free (H_{00}) treatment. The second weight of 1000 grain (26.01g) and harvest index (42.46%) were found Sunrice 150 WG (H_3) treatment which was statistically similar to H_1 and H_2 treatment. The lowest weight of 1000 g (25.02 g) and harvest index (39.06%) was found in control (Ho) treatment. The results showed that among the herbicides Sunrice 150 WG (Ethoxysulfuron) @ 100 g ha^{-1} (H_3) was the best in controlling weeds as an alternative when labour is a limiting factor in production of transplant *aus* rice.

Interaction effect of variety and weed control treatment: The interaction effect of variety and weed control treatment was also found to be statistically significant to all the growth and yield characters except sterile spikelets $panicle^{-1}$ and straw yield (Table 3). The highest number of total tillers $hill^{-1}$ (15.13), number of effective tillers $hill^{-1}$ (11. 13), filled spikelets $panicle^{-1}$ (99.47), and grain yield (3.65 t ha^{-1}) were found in combination of BR3 (V_1) and weed free (Hoo) treatment. The second highest grain yield (2.73 t ha^{-1}) was found in combination of BR3 (V_1) and Sunrice 150 WG @ 100 g ha^{-1} (H_3) treatment which was statistically Similar to $V_2 \times H_0$, $V_2 \times H_{00}$ and V_2 x H_3 treatment. The lowest grain yield (1.06 t ha^{-1}) was found in combination of BR26 (V_3) and control (Ho) treatment. On the other hand, yield reducing character like non effective tillers $hill^{-1}$ (6.67) was highest produced by the interaction of BR26 (V_3) and control (Ho) treatment. The lowest number of non effective tiller $hill^{-1}$ (3.33) was produced by

BR14 (V_2) and weed free treatment (H_{00}). The highest weight of 1000-grain (31.00 g) was found in combination of BR14 (V_2) and weed free (H_{00}) treatment which was statistically similar to V_2H_1, V_2H_2 and V_2H_3 treatment. The lowest weight of 1000-grain (22.03 g) was observed in combination of BR26 (V_3) and weed free (H_{00}) treatment which was statistically similar to V_3H_1, V_3H_2, and V_3H_3 treatment.

The highest harvest index (46.68 %) was found in combination BR14 and control (H_0) treatment. The second highest harvest index (46.20 %) was in combination of BR3 (V_1) and weed free (H_{00}) treatment which was statistically identical to V_2H_2 and V_2H_1 treatment. The lowest harvest index (30.37 %) was found in combination of BR26 (V_3) and control (H_0) treatment (Table 3).

Table 2. Effect of herbicides on yield and yield components of T. aus rice

Weed control treatment	Total tillers hill^{-1}	No. of effective tillers hill^{-1}	No. of non-effective tillers hill^{-1}	Filled spikelets panicle^{-1}	Sterile spikelet panicle^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest Index (%)
H_1	11.15 c	6.42 d	4.73 b	58.50 d	23.07 ab	25.83 b	2.00 d	3.01 c	39.95 c
H_2	11.46 c	6.93 c	4.53 b	64.99 c	21.67 bc	25.71 b	2.27 c	3.06 c	42.40 ab
H_3	12.76 b	8.08 b	4.72 b	73.09 b	20.70 cd	26.01 ab	2.58 b	3.46 b	42.46 b
H_0	10.22 d	4.88 e	5.22 a	43.56 e	24.63 a	25.02 c	1.62 e	2.54 d	39.06 c
H_{00}	14.04 a	9.91 a	4.13 c	82.76 a	18.67 d	26.43 a	2.99 a	3.79 a	43.92 a
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Figures in a column having common letter(s) do not differ significantly at 1% level of probability as per DMRT
H_1= Fastmix EW @ 2 L ha^{-1}; H_2= Comit 500 EC @ 1 L ha^{-1} ; H_3= Sunrice 150 WG @ 100 g ha^{-1}; H_0= Control, H_{00}= Weed free

Table 3. Interaction effect of variety and herbicides on plant parameter in T. *aus* rice

Interaction effect (VXH)	Total tillers hill^{-1}	No. of effective tillers hill^{-1}	No. of non-effective tillers hill^{-1}	Filled spikelets panicle^{-1}	Sterile spikelets panicle^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest Index (%)
V_1XH_1	11.33 defg	6.80 f	4.53 efg	59.01 f	20.88	25.52 cd	2.15 ef	3.2	40.19gh
V_1XH_2	12.53 cd	8.27 de	4.27 fgh	77.76 c	20.24	25.64 cd	2.56 bc	3.5	42.24defgh
V_1XH_3	13.13 bc	8.53 cd	4.73 def	82.55 b	18.37	25.77 cd	2.73 b	3.75	42.13defgh
V_1XH_0	10.60 fgh	5.59 g	4.67 def	42.46 hi	23.32	25.15 d	1.77 gh	2.85	38.31i
V_1XH_{00}	15.13 a	11.13 a	4.00 h	99.47 a	16.34	26.27 c	3.65a	4.25	46.20ab
V_2XH_1	10.47 gh	6.60 f	3.87 h	70.90 d	15.86	30.84 a	2.46bcd	3.05	44.65abd
V_2XH_2	10.06 hi	5.73 g	4.33 fgh	66.97 de	13.90	30.28 a	2.29 cdef	2.73	45.62abc
V_2XH_3	11.96 cde	7.93 e	4.03 gh	76.29 c	15.23	30.83 a	2.62 b	3.43	43.31cdef
V_2XH_0	9.06 i	4.73 h	4.33 fgh	48.11 g	15.44	29.09 b	2.04 fg	2.33	46.68a
V_2XH_{00}	13.13 bc	9.80 b	3.33 i	83.56 b	12.19	31.00 a	2.73 b	3.55	43.47cde
V_3XH_1	11.67 defg	5.87 g	5.80 b	45.61 gh	32.49	21.14 ef	1.39 i	2.77	33.41j
V_3XH_2	11.80 def	6.80 f	5.00 cde	50.24 g	30.87	21.23 ef	1.98 f	2.96	40.08gh
V_3XH_3	13.20 bc	7.80 e	5.40 bc	60.44 f	28.50	21.43 ef	2.39 cde	3.21	42.68defg
V_3XH_0	11.00 efgh	4.33 h	6.67 a	40.12 i	35.15	20.82 f	1.06 j	2.43	30.37k
V_3XH_{00}	13.87 b	8.80 c	5.07 cd	65.25 e	27.50	22.03 e	2.59 bc	3.56	42.11defgh
Level of significance	0.05	0.01	0.01	0.01	ns	0.01	0.01	ns	0.01

Figures in a column having common letter(s) do not differ significantly at 1% level of probability as per DMRT
V_1= BR3; V_2= BR14; V_3= BR26; H_1= Fastmix EW @ 2 L ha^{-1}; H_2= Comit 500 EC @ 1 L ha^{-1}; H_3= Sunrice 150 WG @ 100 g ha^{-1}; H_0= Control; H_{00}= Weed free

From the results stated above it may be seen that BR3 (V_1) was the best variety in *aus* season in terms of grain and straw yield among the varieties tested. Among the herbicides Sunrice 150 WG (Ethoxysulfuron) @ 100 g ha^{-1} was the best in controlling weeds and the treatment combination of BR3 (V_1) and the Sunrice 150 WG @ 100 g ha^{-1} (H_3) was the second most profitable and as an alternative when labour is a limiting factor in production of Transplanted *aus* rice.

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