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Effect of variety and weeding regime on the yield components and yield of *Aus* rice

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Abstract

A field experiment was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, during the period from April to July 2012 to study the effect of variety and weeding regime on the yield components and yield of *Aus* rice. The experiment was laid out in a randomized complete block design with three replications. The experimental treatments comprised four varieties viz. BR 26, BRRI dhan27, BRRI dhan48 and Pariza; and five weeding treatments viz. no weeding, one hand weeding at 20 DAS(Days after sowing), two hand weeding at 20 DAS and 30 DAS, three hand weeding at 20, 30 and 40 DAS and weed free. Here broadcasting method of planting was used. Results revealed that varieties had significant effect on plant height, 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 unfilled spikelets panicle^{-1}, 1000-grain weight, grain yield, straw yield, biological yield and harvest index. Grain yield was the highest in BRRI dhan48. Weeding regime had also significant effect on all the studied crop parameters except 1000-grain weight. The highest grain yield was obtained from weed free condition followed by three, two and one weeding conditions. Interaction between variety and weeding regime significantly influenced all the studied crop parameters except 1000-grain weight and harvest index. In interaction it was observed that the highest grain yield was obtained from BRRI dhan48 under two weeding condition.

Keywords: *Aus* rice, Variety, Weeding regime, Yield

Introduction

Rice (*Oryza sativa* L.) is the most extensively cultivated crop in Bangladesh and the staple food for her people. Bangladesh is an agricultural country with plenty of water and suitable climatic condition for rice production. In respect of area and production it ranks fourth among the rice producing countries of the world following China, India and Indonesia (FAO, 2009).Food shortage is one of the major problems here due to over population and low yield of food crops. To meet this shortage, achieving self-sufficiency on food is a crying need. To reach the goal, it is necessary either to increase the crop area or to increase yield in unit^{-1} area. But due to high population pressure, horizontal expansion of land is not possible. So, increasing yield unit^{-1} area is the only means.In Bangladesh, agriculture is characterized by rice based cropping systems. Rice is extensively grown here in *Aus*, *Aman*, and *Boro*seasons. Variety itself is a genetic factor which contributes a lot in producing yield components and yield of a particular crop. Yield components such as number of effective tillers hill^{-1}, number of grains panicle^{-1} and weight of individual grain contribute to increase or decrease the yield.Weeds are considered as a major constraint among the various factors of lowering the rice yield. Weeds compete with rice plants severely for space, nutrients, air, water and light by adversely affecting plant height, leaf architecture, tillering habit, shading ability, growth pattern and crop duration (IRRI, 1968; Ahmed and Haque, 1981; Pernito *et al*., 1986). Weeding in *Aus* rice gives a good response in terms of grain yield. Timely weeding is necessary for having higher grain yield and better economic return (Gaffer *et al*., 1988). Weeding, therefore, has a good influence on the performance of rice crops. The present study was, therefore, undertaken to evaluate the performance of four varieties of *Aus* rice, to find out the number of weeding necessary for successful *Aus* rice production; and to observe the interaction effect of variety and weeding regime on the yield components and yield of *Aus* rice.

Materials and Methods

The experiment was conducted with broadcast *Aus* rice (*Oryza sativa* L.) at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, during the period from April to July 2012 to study the effect of variety and weeding regime on the yield components and yield of broadcast *Aus* rice.

The experimental area belongs to the Agro-ecological Zone of the Old Brahmaputra floodplain (AEZ-9), having non-calcareous dark grey floodplain soil (FAO, 2009). The experiment field was medium high land having sandy loam soil with pH 6.8. The experiment included two factors, four varieties viz. BR 26, BRRI dhan27, BRRI dhan48 and Pariza. Broadcasting method was followed here and five weeding viz. no weeding, one hand weeding at 20 DAS, Two hand weeding at 20 DAS and 30 DAS, Three hand weeding at 20, 30 and 40 DAS and Weed free. The experiment was laid out in randomized complete block design with three replications. The area of each unit plot was 4.0m× 2.5 m. The spaces between blocks and between plots were 1 m and 75 cm, respectively. The land was opened with a power tiller on 19 April 2012. The field was thoroughly prepared with the help of country plough and ladder and was uniformly fertilized with urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate @ 80, 60, 40, 60 and 10 kg ha^{-1}, respectively. All of the fertilizers were applied at the final land preparation but urea was applied at 3 equal split applications at 15, 30 and 45 days after sowing (DAS). The land was finally prepared on 24 April 2012. The field layout was done on the next day. Then the seeds were sown in the field on 25 April 2012. The intercultural operations were done whenever it necessary. When 90% of the spikelets became golden yellow in colour, the crop was harvested just above ground level on 22July 2012. The harvested crop of each plot was separately bundled, properly tagged and then brought to threshing floor. The grains were cleaned and sun dried and straws were also sun dried properly. Finally grain and straw yields $plot^{-1}$ were recorded and converted to t ha^{-1}. Grain yield was adjusted to 14% moisture content. Data recorded for different parameters were compiled and tabulated in proper form. Analysis of variance was done following Randomized Complete Block Design with the help of computer package program MSTAT. The mean differences among the treatments were tested with Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Effect of variety on yield components and yield of *Aus* rice

Plant height, 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 unfilled spikelets $panicle^{-1}$, weight of 1000 grains, grain yield, straw yield, biological yield and harvest index were significantly affected by variety (Table 1). Variety BRRI dhan48 produced the tallest plant (100.13 cm) followed by Pariza (69.69 cm) which was as good as BRRI dhan27 (68.37 cm), while the shortest plant (66.06 cm) was recorded in variety BR26. Pariza produced the highest number (11.13) of total tillers and effective tillers $hill^{-1}$ (9.44) followed by BRRI Dhan48, BRRI dhan27and BR 26.The variety BR 26 produced the highest number of non-effective tillers $hill^{-1}$ (2.30) which was identical to BRRI dhan27 (2.27) and the variety BRRI dhan48 produced the lowest number of non-effective tillers $hill^{-1}$ (1.42). BINA (1993) reported that number of non-effective tillers $hill^{-1}$ was significantly influenced by variety. The highest number ofgrains $panicle^{-1}$ (114.31) was produced by the variety Pariza which was as good as BRRI dhan48 (113.89) followed by BRRI dhan27 (87.48) and the lowest one (85.56) by BR26. Singh and Gangwar (1989) reported variable number of grains $panicle^{-1}$ among the varieties. Varietal differences regarding the number of grains $panicle^{-1}$ might be due to differences in genetic constituents. The variety Pariza produced the highest number of unfilled spikelets $panicle^{-1}$ (16.49) and variety BRRI dhan27 produced the lowest (12.62) number of unfilled spikelets $panicle^{-1}$. The highest weight (22.88 g) of 1000 grains was found in BRRI dhan48 followed by BRRI dhan27 (21.46) which was identical to Pariza (21.18) and the lowest weight (20.02 g) of 1000 grains was observed in BR26. This might be due to coarse grains of BRRI dhan48. Rafey *et. al.* (1989) who stated that weight of 1000 grains differed due to varietal differences. The highest grain yield (4.07 t ha^{-1}) was obtained in BRRI dhan48 followed by Pariza (3.84) and BRRI dhan27 (3.530). The lowest grain yield (2.57 tha^{-1}) was found in BR26.However, the highest straw yield (4.53 t ha^{-1}) was obtained in BRRI dhan48 and the lowest straw yield (3.80 t ha^{-1}) was obtained in BR26. These results are in conformity with that obtained by Chowdhury *et. al.* (1993) who reported the differences in straw yield among the varieties.The highest biological yield (8.60 t ha^{-1}) and the highest harvest index (47.26) were recorded in BRRI dhan48 and the lowest biological yield (6.36 t ha^{-1}) and the lowest harvest index (39.39 were recorded in BR26.It was reported that variety had a great influence to biological yield and harvest index.

Table 1. Effect of variety and weeding regime on yield components and yield of *Aus* rice

Treatments	Plant height (cm)	No. of total tillers hill^{-1}	No. of effective tillers hill^{-1}	No. of non-effective tillers hill^{-1}	No. of grains panicle^{-1}	No. of unfilled spikelets Panicle^{-1}	1000 grain weight (g)	Grain yield (t ha^{1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest Index (%)
Variety											
V_1	66.06c	7.60d	5.30d	2.30a	85.56b	15.04b	20.02c	2.57d	3.80	6.36d	39.39b
V_2	68.37b	8.87c	6.60c	2.27a	87.48b	12.62d	21.46b	3.53c	3.93	7.45c	46.95a
V_3	100.13a	10.11b	8.69b	1.42b	113.89a	13.44c	22.88a	4.07a	4.53	8.60a	47.26a
V_4	69.69b	11.13a	9.44a	1.69b	114.31a	16.49a	21.18b	3.84b	4.29	8.13b	47.18a
CV (%)	2.54	5.23	6.24	5.23	7.48	7.25	4.25	3.96	5.82	4.91	4.97
Level of sig.	**	**	**	**	**	**	**	**	**	**	**
Weeding regime											
W_0	71.15d	6.22e	3.97e	2.25a	66.33e	23.40a	20.90	2.46e	3.62d	6.08e	39.36b
W_1	75.85c	7.93d	5.64d	2.28a	93.48d	14.47b	21.46	3.40d	3.98c	7.38d	45.76a
W_2	77.73b	10.21c	8.07c	2.14a	106.40c	13.25bc	21.73	3.71c	4.17bc	7.88c	46.73a
W_3	76.16bc	10.89b	9.35b	1.54b	109.56b	13.03c	21.24	3.84b	4.36ab	8.20b	46.90a
W_4	79.42a	11.90a	10.51a	1.39b	125.79a	7.85d	21.59	4.09a	4.55a	8.65a	47.24a
CV (%)	2.54	5.23	6.24	5.23	7.48	7.25	4.25	3.96	5.82	4.91	4.97
Level of sig.	**	**	**	**	**	**	NS	**	**	**	**

In a column, the figures having common or without letter(s) do not differ significantly as per DMRT.
V_1= BR 26 (Sraboni), V_2= BRRI dhan27, V_3= BRRI dhan48, V_4= Pariza ,
W_0 = No weeding ,W_1= One hand weeding - at 20 DAS, W_2 = Two hand weeding - at 20 DAS and 30 DAS, W_3 = Three hand weeding - at 20, 30 and 40 DAS
W_4 = Weed free.
** = Significant at 1% level of probability, NS = Non-significant

Effect of weeding regime on yield components and yield of *Aus* rice

Plant height, 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 unfilled spikelets panicle^{-1}, grain yield, straw yield, biological yield and harvest index were significantly influenced by weeding (Table 1). The highest plant height (79.4 cm) was found in W_4 (weed free condition) among the weeding treatments while the lowest (71.15cm) plant height was obtained in no weeding condition. Chowdhury *et. al.* (1994) reported that the highest plant height was produced due to weed free condition and the lowest plant height was in no weeding condition. The highest number of total tillers (11.90) and effective tillers (10.51) hill^{-1} were obtained from W_4(weed free) condition followed by W_3 (three hand weeding at 20, 30and 40 DAS) and W_2 (two hand weeding at 20 and 30 DAS) but the lowest number of total tillers (6.22) and effective tillers hill^{-1} (3.97) were obtained from W_0 (no weeding) condition. It indicated that weed free condition encouraged the highest tiller formation and negative effect of weeds on plant growth resulted in decreased number of total and effective tillers. De Datta (1990) observed that effective weed management increased number of effective tillers hill^{-1} due to more availability of water, nutrients and light. Similar results were supported by Singh *et al.* (1999). The highest number of non-effective tillers hill^{-1} (2.28) was obtained from W_1 (One hand weeding at 20 DAS) among the weeding conditions. The lowest number of non-effective tillers hill^{-1} (1.39) was obtained from W_4 (weed free) condition. The highest number of grains panicle^{-1} (125.79) was found in W_4 (weed free) followed byW_3 (three hand weeding at 20, 30and 40 DAS) and W_2 (two hand weeding at 20 and 30 DAS) while the lowest number of grains(66.33) panicle^{-1} was found from W_0 (no weeding) condition(Gaffer *et. al.*, 1988). It indicated that weed free condition produced more number of grains panicle^{-1}.The highest number of unfilled spikelets (23.40) panicle^{-1}was found in W_0 (no weeding) and the lowest number of unfilled spikelets (7.85) panicle^{-1} was found in W_4 (weed free) condition. These findings is in close agreement with the findings to Rafiquddaulla (1999) who found the highest unfilled spikelets panicle^{-1} from no weeding and the lowest from weed free regime. The weight of 1000-grain was not influenced by weeding (Table 1). Apparently the weight of 1000-grain was highest (21.73 g) in W_2 (Two hand weeding at 20 DAS and 30 DAS) and the weight of 1000-grain was lowest (20.90 g) in W_0 (no weeding) condition. The highest grain yield (4.09 t ha^{-1}) was found from W_4 (weed free) condition followed by W_3 (three hand weeding at 20, 30and 40 DAS) and W_2 (two hand weeding at 20 and 30 DAS) and the lowest grain yield (2.46 t ha^{-1}) was found from W_0 (no weeding) condition. Under weed free condition, plants got maximum nutrients, light and water, which resulted in maximum grain yield. The present result is in conformity with the earlier results of Bari *et al.* (1995) who found the highest grain yield in weed free regime. Similarly Chowdhury *et. al.* (1995) reported that the highest grain yield was produced from weed

free plot as a result of less competition of weeds. Weed free treatment (W_4) produced the highest straw yield (4.55 t ha^{-1}),highest biological yield (8.65 t ha^{-1}) and highest harvest index (47.24%).The lowest straw yield (3. 62 t ha^{-1}),the lowest biological yield (6.08 t ha^{-1}) and the lowest harvest index (39.36%) were found from W_0 (no weeding) condition.

Interaction of variety and weeding regime on yield components and yield of *Aus* rice

The interaction between variety and weeding had significant effect on plant height, 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 unfilled spikelets $panicle^{-1}$,grain yield, straw yield and biological yield at harvest (Table 2). The highest plant height was (104.20 cm) found in BRRI dhan48 under weed free ($V_3 \times W_4$) condition and the lowest (62.76 cm) in BRRI dhan27 under no weeding ($V_2 \times W_0$) condition. The highest number of total tillers (14.60)$hill^{-1}$ was in Pariza under weed free condition($V_4 \times W_4$) and the lowest (4.50 cm) in BR 26 under no weeding ($V_1 \times W_0$) among the interactions. The highest number (13.00) of effective tillers $hill^{-1}$ was found in Pariza under weed free ($V_4 \times W_4$) condition. The lowest number of effective tillers (2.13) $hill^{-1}$ was found in BR 26 under no weeding ($V_1 \times W_0$) condition. The number of non-effective tillers $hill^{-1}$ was the highest (3.39) in BRRI dhan27 under no weeding condition ($V_2 \times W_0$). The lowest number of non-effective tiller (1.04) s $hill^{-1}$ was found in BRRI dhan48 under weed free condition ($V_3 \times W_4$). The highest number (142.52) of grains $panicle^{-1}$ was found in BRRI dhan48 under weed free ($V_3 \times W_4$) condition. The lowest number of grains (61.24) $panicle^{-1}$ was found in BRRI dhan27 under no weeding ($V_2 \times W_0$) condition. The highest number of unfilled spikelets (30.13) $panicle^{-1}$ was found in BR 26 under no weeding ($V_1 \times W_0$) condition. The lowest number of unfilled spikelets (6.95) $panicle^{-1}$ was found in BRRI dhan27 under weed free ($V_2 \times W_4$) condition. The highest (4.54 t ha^{-1}) grain yield was found in BRRI dhan48 under two weeding ($V_3 \times W_2$) condition and the lowest (1.20 t ha^{-1}) in BR 26 under no weeding ($V_1 \times W_0$) condition. The highest straw yield (4.85 t $ha^{-1}$was found in Pariza under three weeding ($V_4 \times W_3$) condition and the lowest straw yield (3.22 t ha^{-1}) was found in BRRI dhan27 under no weeding ($V_2 \times W_0$) condition. The highest biological yield (9.15 t ha^{-1}) was found in BRRI dhan48 under two weeding ($V_3 \times W_2$) condition and the lowest biological yield (4.83 t ha^{-1}) was found in BR 26 under no weeding ($V_1 \times W_0$) condition. So here we found that the highest grain yield (4.54 t ha^{-1}) and biological yield (9.15 t ha^{-1}) were obtained from the variety BRRI dhan48 under two hand weeding at 20 DAS and 30 DAS.

Table 2. Interaction of variety and weeding regime on yield components and yield of *Aus* rice

Interaction (V×W)	Plant height (cm)	No. of total tillers $hill^{-1}$	No. of effective tillers $hill^{-1}$	No. of non-effective tillers $hill^{-1}$	No. of grains $panicle^{-1}$	No. of unfilled spikelets $panicle^{-1}$	1000- grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	HI (%)
$V_1 \times W_0$	63.43i	4.50L	2.13j	2.37bc	62.23Lm	30.13a	19.73	1.20k	3.63e	4.83i	24.85
$V_1 \times W_1$	67.35gh	5.92k	2.72ij	3.20a	73.27k	15.34d	20.05	2.41j	3.82de	6.23g	38.92
$V_1 \times W_2$	66.01ghi	8.13i	5.03h	3.10a	89.69i	12.13e	20.08	2.66i	3.78de	6.44fg	41.35
$V_1 \times W_3$	68.17fgh	9.26gh	8.01fg	1.25e	96.39h	10.29ef	20.22	3.22gh	3.75de	6.96def	46.40
$V_1 \times W_4$	65.36hi	10.19ef	8.63ef	1.57de	106.23fg	7.32gh	20.05	3.34g	4.01cde	7.35de	45.45
$V_2 \times W_0$	62.76i	6.57jk	3.18i	3.39a	61.24m	24.64b	21.74	2.35j	3.22e	5.57h	42.17
$V_2 \times W_1$	67.94gh	7.44ij	4.74h	2.70ab	76.61k	10.92e	21.18	3.30gh	3.68f	6.97def	47.30
$V_2 \times W_2$	69.39efg	9.56fgh	7.29g	2.27bcd	83.02j	7.92fgh	21.92	3.61f	3.87de	7.48d	48.22
$V_2 \times W_3$	69.75efg	10.10efg	8.44ef	1.66cde	102.88g	12.65e	21.49	3.88e	4.21bcd	8.10c	47.99
$V_2 \times W_4$	72.03e	10.68de	9.33de	1.35e	113.66de	6.95h	20.98	4.49a	4.66ab	9.14a	49.07
$V_3 \times W_0$	94.85c	7.01j	5.50h	1.52de	74.24k	19.57c	22.07	3.22gh	3.90de	7.12de	45.26
$V_3 \times W_1$	98.36b	9.09h	7.67fg	1.42e	108.75ef	15.60d	23.13	4.31abc	4.62ab	8.94ab	48.27
$V_3 \times W_2$	103.75a	10.80de	9.40de	1.40e	117.51d	10.65e	23.41	4.54a	4.61ab	9.15a	49.66
$V_3 \times W_3$	99.49b	11.51cd	9.82cd	1.69cde	126.42c	11.47e	22.18	4.09cde	4.64ab	8.73ab	46.88
$V_3 \times W_4$	104.20a	12.11bc	11.07b	1.04e	142.52a	9.92efg	23.59	4.20bcd	4.88a	9.08a	46.24
$V_4 \times W_0$	63.57i	6.78jk	5.08h	1.70cde	67.63L	19.26c	20.07	3.07h	3.73e	6.80ef	45.16
$V_4 \times W_1$	69.77efg	9.25gh	7.44g	1.81cde	115.27d	16.01d	21.48	3.59f	3.80de	7.39d	48.54
$V_4 \times W_2$	71.76ef	12.32bc	10.53bc	1.79cde	135.36b	22.31b	21.53	4.02de	4.42abc	8.44bc	47.68
$V_4 \times W_3$	67.23gh	12.69b	11.14b	1.55de	112.52de	17.69cd	21.07	4.18bcd	4.85a	9.02a	46.32
$V_4 \times W_4$	76.10d	14.60a	13.00a	1.61cde	140.77ab	7.20h	21.74	4.34ab	4.67ab	9.01a	48.21
CV (%)	2.54	5.23	6.24	5.23	7.48	7.25	4.25	3.96	5.82	4.91	4.97
Level of sig.	**	**	**	**	**	**	NS	**	**	**	NS

In a column, the figures having common or without letter(s) do not differ significantly as per DMRT.
V_1= BR 26 (Sraboni), V_2= BRRI dhan27, V_3= BRRI dhan48, V_4= Pariza
W_0 = No weeding, W_1 = One hand weeding - at 20 DAS, W_2 = Two hand weeding - at 20 DAS and 30 DAS, W_3 = Three hand weeding - at 20, 30 and 40 DAS, W_4= Weed free, CV = Co-efficient of Variation, LSD=Least significant difference, ** = Significant at 1% level of probability, NS = Non-significant.

From the results of the experiment it can be concluded that the variety BRRI dhan48 is suggested to cultivate in *Aus* season under broadcasting method with two weeding at 20 DAS and 30 DAS for better yield. However, further experiments are suggested to be conducted in different agro-ecological zones to arrive at a definite conclusion.

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