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Effect of Varieties of Rice and Weeding on Weed Growth and Yield of Transplant Aman Rice

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Abstract: An experiment was conducted at the Agronomy Field Laboratory, BAU, Mymensingh during June to December 2000 to assess the effect of varieties of transplanted aman rice and weeding regimes on weed growth and yield of transplant aman rice. Five varieties and five weeding were used in the experiment. The results revealed that BRRI dhan 34 was the most competitive variety, which provided with the least accumulation of weed dry matter per unit area. The ranking was BRRI dhan 34 ≈ Binashail > Nizershail > BRRI dhan 39 ≈ BRRI dhan 33 The ranking of the varieties in respect of grain yield was BRRI dhan 39 ≈ BRRI dhan 33 > Binashail > BRRI dhan 34 > Nizershail. The effect of weeding regimes produced significant differences on the weed growth and grain yield of transplant aman rice. The reduction of weed dry matter was similar in both two weeding and three weeding regimes. The highest grain yield was noted under three weeding conditions (3.95 t ha^{-1}) which was at par with weed free (4.01 t ha^{-1}), but dissimilar to two weeding regimes (3.71 t ha^{-1}).

Key words: Variety, weeding, growth, yield, transplant aman rice

Introduction

In Bangladesh, rice (*Oryza sativa* L.) is the staple food crop covering an area of about 10.8 million hectares with an average production of 18.88 million tons annually (BBS, 1997). In this country, rice is grown under diverse ecosystem irrigated, rainfed and deep water conditions in the four distinct rice growing seasons, namely Aus, Transplant aman, Broadcast aman and Boro (Alim, 1982). Transplant aman rice covers the largest area of 5.7 million hectares with a production of 9.3 million tons of rice grain and the average yield is about 1.63 t ha^{-1} (BBS, 1994). Transplant aman rice covers about 48.67% of total rice area and it contributes to 42.78% of the total rice production (BBS, 1998). But in this crop, yield is much lower than that in other rice growing countries of the world. Severe weed infestation constitutes one of the important reasons for such low yield (Mamun, 1988). The yield loss due to weed competition in transplant aman rice is 40% in Bangladesh (BRRI, 1981). Crop loss due to unrestricted growth of weeds in the fields in Bangladesh has been estimated to be TK. 23,000 million per year (Karim, 1987). Weeds grow in the crop fields throughout the world. It is often said, "crop production is a fight against weeds" (Mukhopadhyay and Ghosh, 1981). Where there is cultivable land, there is weed. Subsistence farmers of the tropics spend more time, energy and money on weed control than any other aspect of crop production (Kasasian, 1971). Poor weed control is one of the major factors for yield reduction in rice (Amarjit *et al.,* 1994). Although, a number of experiments were done on the effects of weed competition on the yield and yield components of rice (Alam *et al.*, 1995; Bari *et al.*, 1995), but sufficient study on the competitive ranking of different varieties against weeds has not yet been done in Bangladesh. Appropriate weeding regimes for economic weed control in the varieties under study has not also been done here. The overall aim of this research was to rank the varieties of transplant aman rice on the basis of their competitive ability against weeds. Therefore, an experiment was undertaken to assess the effect of varieties of transplanted aman rice and weeding regimes on weed growth and yield of transplant aman rice.

Materials and Methods

The study was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University (BAU), Mymensingh during the period from June to December 2000. The seeds were collected from the Bangladesh Rice Research Institute, Gazipur; BINA, Mymensingh and the CFS Farm, Bangladesh Agricultural University, Mymensingh, Bangladesh. Seedbed was prepared by several ploughings and cross ploughings followed by laddering and the weeds were removed. The seedling nursery was divided into five separate plots for five varieties of rice. The size of the seedbed was 1.5 x 5.0 m. The seeds were soaked in water for 24 h and then these were kept in Jute bag in dark condition for 48 h. Sprouted seeds were sown in seedbed. First two ploughings were given by power tiller. After a few days, the land was further ploughed and cross-ploughed by country plough followed by laddering until a good tilth was achieved. The land was then ready for transplanting. Thirty days old seedlings were uprooted carefully from the nursery. The graded and selected seedlings were transplanted in the unit plots. Three seedlings hill^{-1} were transplanted maintaining a row to row distance of 20cm and hill to hill 15cm. The land was fertilized with 150-100-70-60-10 kg ha^{-1} in the form of Urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate, respectively and fertilizers were applied as per recommendation of BRRI (2000). The experiment was laid out in a split-plot design with three replications. Five varieties viz. BRRI dhan 39 (V_1), BRRI dhan 33 (V_2), Binashail (V_3), BRRI dhan 34 (V_4) and Nizershail (V_5) were placed in the main plot and weeding treatments were placed in the sub-plot. Four weeding and one control were used in sub-plot. There were 75 plots in the experiment and size of the individual plot was 4.0 x 2.5 m. The data were recorded on Weed dry weight at 20, 40 and 60 DAT, Crop biomass, Plant height (cm), Number of total tillers hill^{-1} Number of effective tillers hill^{-1}, Number of non-effective tillers hill^{-1}, Panicle length (cm), Number of filled grains panicle^{-1}, Number of unfilled grains panicle^{-1}, Weight of 1000-grains (g), Grain yield (t ha^{-1}), Straw yield (t ha^{-1}), Harvest index (%), Plant height. The recorded data were compiled and tabulated properly and then subjected to statistical analysis. The mean differences among the treatments were adjudged by DMRT (Gomez and Gomez, 1984).

Results and Discussion

Effect of variety on weed dry weight: Weed dry weight was significantly influenced by the variety. The highest mean weed dry weight (19.48 g m^{-2}) was observed from the variety BRRI dhan 39, which was similar to BRRI dhan 33 (19.27 g m^{-2}) (Table 1). The lowest weed dry weight was observed (17.38 g m^{-2}) from the variety BRRI dhan 34, which was similar to Binashail (17.72 g m^{-2}). More or less similar accumulation of weed dry matter was noted in three sampling dates. Since BRRI dhan 34 is the tallest variety of the four under study, it suppressed the weeds more. Binashail on the other hand is taller variety with more foliage, which rendered more shading and suppressed the weed growth.

Effect of weeding regimes on weed dry matter: Weed dry matter was influenced by the weeding regimes. The highest mean weed dry matter (47.42g m^{-2}) was found from the no weeding treatment. Although at 20 DAT, the weed dry weight of no weeding and one weeding treatment was identical, the mean value of three sampling

Table 1: Effect of variety of transplant aman rice on weed dry weight at different sampling dates

Variety	Weed dry weight (g) 20 DAT	40 DAT	60 DAT	Mean
BRRI dhan 39	11.56a	18.55a	28.32a	19.48a
BRRI dhan 33	11.33a	18.42a	28.06ab	19.27a
Binashail	9.26b	17.63b	26.27c	17.72c
BRRI dhan 34	8.77b	17.53b	25.84d	17.38c
Nizershail	8.834b	17.74b	27.64b	18.07b

Table 2: Effect of weeding regimes on accumulation of weed dry weight at different sampling dates

Weeding regimes	Weed dry weight (g) 20 DAT	40 DAT	60 DAT	Mean
No weeding	12.15a	44.18a	85.92a	47.42a
Weed free	-	-	-	-
One weeding	12.04a	15.76b	30.20b	19.33b
Two weeding	11.64a	15.63bc	9.85c	12.37c
Three weeding	10.89a	15.30c	9.46c	11.88c

Table 3: Effect of variety and weeding regimes interaction on accumulation of weed dry weight at different sampling dates

Interaction on Variety × Weeding regimes	Weed dry weight (g) 20 DAT	40 DAT	60 DAT	Mean
V_1W_0	16.67a	43.45c	90.50a	50.21b
V_1W_F	-	-	-	-
V_1W_1	8.25i	15.00jkl	33.40e	18.88h
V_1W_2	9.02gh	15.00jkl	10.20l	11.41l
V_1W_3	9.03gh	15.20ijk	8.96m	11.06m
V_2W_0	15.60b	47.42a	90.10b	51.04a
V_2W_F	-	-	-	-
V_2W_1	15.64b	15.20ijk	32.10g	20.98e
V_2W_2	13.95c	15.30ij	9.11m	12.79I
V_2W_3	12.65e	14.20m	8.90m	11.92k
V_3W_0	13.87c	42.30d	84.00d	46.72d
V_3W_F	-	-	-	-
V_3W_1	13.86c	16.20h	30.10h	20.05f
V_3W_2	13.33d	15.30ij	10.10l	12.91i
V_3W_3	12.67e	14.33m	8.99m	12.00jk
V_4W_0	16.67a	46.53b	79.40e	47.53c
V_4W_F	-	-	-	-
V_4W_1	9.36g	20.30f	27.20j	18.25h
V_4W_2	9.37g	15.2ijk	11.20k	11.92k
V_4W_3	9.90f	14.70l	10.10l	11.57l
V_5W_0	13.02d	41.20e	85.60c	46.61d
V_5W_F	-	-	-	-
V_5W_1	13.10d	17.10g	28.20i	19.47g
V_5W_2	8.82h	15.50i	10.10l	11.47l
V_5W_3	9.23g	14.90kl	8.90m	11.01m

In a column figures having similar letter (s) do not differ significantly whereas dissimilar letter (s) differ significantly as per DMRT

DAT = Days after transplanting

Table 4: Effect of variety and weeding regime on the crop biomass loss (%)

Variety	Weeding regimes No weeding	One weeding	Two weeding	Three weeding	Mean*
BRRI dhan 39	12.22	10.72	10.21	8.68	9.95c
BRRI dhan 33	15.98	14.20	10.65	8.88	12.42b
Binashail	18.45	17.85	8.93	5.92	12.78a
BRRI dhan 34	10.37	9.03	4.80	3.01	6.80d
Nizershail	16.94	16.94	10.31	5.46	12.41b
Mean*	14.47a	13.75b	8.98c	6.39d	-

In a column/row figures having similar letter (s) do not differ significantly whereas dissimilar letter (s) differ significantly as per DMRT

Table 5: Effect of variety on plant characters, yield and yield components of transplant aman rice

Variety	Plant height (cm)	No. of total tillers hill^{-1}	No. of effective tillers hill^{-1}	No. of non-effective tillers hill^{-1}	Panicle length (cm)	No. of filled grains panicle^{-1}	No. of non-filled grains panicle^{-1}	Weight of 1000-grains(g)	Straw yield (t ha^{-1})	Harvest index (%)
BRRI dhan 39	103.30d	10.64a	8.42a	2.28b	21.55c	90.14c	17.98b	22.38a	5.23b	44.53a
BRRI dhan 33	97.98e	9.02c	6.20d	2.82a	21.44c	80.07e	17.63b	21.28b	5.14b	44.61a
Binashail	137.90a	8.26d	6.29d	2.03c	23.95b	99.01b	16.73c	16.36c	5.23a	38.23b
BRRI dhan 34	115.80c	9.40bc	7.61b	1.85c	25.14a	131.40a	22.76a	10.49d	5.25b	38.75b
Nizershail	129.00b	9.68b	7.20c	2.74a	22.18c	86.21d	15.16d	16.42c	5.31b	36.56c

Table 6: Effect of weeding regimes on plant characters, yield and yield components of different transplant aman rice

Weeding regimes	Plant height (cm)	No. of total tillers hill^{-1}	No. of effective tillers hill^{-1}	No. of non-effective tillers hill^{-1}	Panicle length (cm)	No. of filled grains panicle^{-1}	No. of non-filled grains panicle^{-1}	Weight of 1000-grains(g)	Straw yield (t ha^{-1})	Harvest index (%)
No weeding	113.60 b	8.66d	6.03c	3.24a	22.34b	82.38d	21.36a	17.25	4.94c	40.85
Weed free	119.80ab	10.34a	8.20a	1.94d	23.53a	111.50a	14.86e	17.57	5.83a	40.65
One weeding	114.00c	8.92cd	6.36c	2.61b	22.34b	88.43c	20.50b	17.18	5.20bc	39.66
Two weeding	117.40b	9.31bc	7.16b	2.140c	22.72ab	95.93b	17.43c	17.46	5.39b	40.52
Three weeding	119.70a	9.76b	7.97a	1.79d	23.34a	108.60a	16.11d	17.50	5.82a	41.00

In a column figures having similar letter (s) do not differ significantly whereas figures with dissimilar letter (s) differ significantly as per DMRT
NS = Non significant

dates was significantly less. Weed dry matter of 11.88g m^{-2} was observed from the three weeding regimes, which was similar to two weeding treatments (12.37 g m^{-2}). The accumulation of weed dry matter was more or less similar under two or three weeding treatments (Table 2).

Effect of variety and weeding regimes interaction on weed dry matter: Weed dry matter was significantly influenced by the interaction between variety and weeding regimes (Table 3). In the case of 20 DAT, The highest weed dry weight (16.67 g) was observed from the interaction of $V_1 \times W_0$, which was statistically similar to $V_4 \times W_0$ (16.67 g) and the lowest weed dry weight was found (8.25 g) from the interaction of $V_1 \times W_1$. In the case of 40 DAT, the highest weed dry weight (47.72 g) was found from the interaction of $V_2 \times W_0$ and lowest weed dry weight (14.20 g) was observed from the interaction of $V_2 \times W_3$. In the case of 60 DAT, the highest weed dry weight (90.50 g) was observed from the interaction of $V_1 \times W_0$ and lowest weed dry weight (8.90 g) was observed from the interaction of $V_5 \times W_3$, which was statistically similar to the interaction of $V_3 \times W_3$ (8.99 g), $V_2 \times W_3$ (8.90 g), $V_2 \times W_2$ (9.11g) and $V_1 \times W_3$ (8.96 g). The highest mean weed dry weight (50.04 g) was observed from the interaction of $V_2 \times W_0$ and lowest mean weed dry weight was observed from the interaction of $V_5 \times W_3$ (11.01 g), which was statistically similar to the interaction of $V_1 \times W_3$ (11.06 g). From the results discussed above it appeared that weed dry weight at 20 DAT, 40 DAT and 60 DAT increased gradually but it was differed from the mean weed dry weight.

Effect of variety and weeding regimes on crop biomass loss: Crop biomass loss (%) was significantly influenced by the variety. It was recorded that the highest crop biomass loss (12.78%) was found from the variety Binashail in comparison to its pure stands (weed free treatment) and BRRI dhan 33 was the second highest. It is to be noted that the lowest loss of crop biomass in BRRI dhan 34 (6.60%) was supported by the fact there was the lowest accumulations of weed dry weight (Table 4). However, the highest loss of crop biomass in Binashail but there was least weed dry weight and the reason for this was not clear to the author. Harper (1977) stated that the behaviour of plant in pure stands could not be compared with the behaviour in mixture with weeds. Crop biomass loss was affected by weeding regimes. The highest crop biomass loss (14.47%) was observed from the no weeding regime and percentage of loss was decreased progressively with the increase in number of weeding. Weeding surely contributed to crop biomass the contribution from three hand weeding was significantly higher than all are two-hand weeding. Similarly contribution of three hand weeding were significantly higher than one weeding. Crop biomass loss (%) significantly influenced by the variety × weeding regime interaction. The highest crop biomass loss (18.45%) was recorded from the interaction $V_3 \times W_0$, which followed by the interaction $V_3 \times W_1$ (17.85%). The lowest crop biomass loss (3.01%) was observed from the interaction $V_4 \times W_3$ (Table 4).

Effect of variety on yields and yield components: Yield and yield components are significantly affected by the variety and weeding regimes. Plant height at harvest varied significantly among the five varieties (Table 5). The tallest plant height (137.9 cm) was observed in Binashail and the shortest plant height (97.98 cm) was observed in BRRI dhan 33. The ranking of varieties in respect of plant height was Binashail > Nizershail > BRRI dhan 34 > BRRI dhan 39 > BRRI dhan 33. The genetic make-up of the cultivars was responsible for the variation in plant height. BRRI (1995) also reported that plant height differed among varieties. The results showed that the number of total tillers hill^{-1} was significantly influenced by the variety at harvest (Table 5). The highest number of total tillers hill^{-1} (10.64) was observed in variety BRRI dhan 39, which was significantly higher than other varieties. The lowest number of total tillers hill^{-1} (8.26) was observed in Binashail. However, BRRI dhan 33, BRRI dhan 34 and Nizershail produced statistically similar number of tiller hill^{-1}. Similar effects were observed in total number of tillers hill^{-1} as noted in the case of number of effective tillers hill^{-1}. The highest number (8.42) of effective tillers hill^{-1} was observed in BRRIdhan 39 followed by BRRI dhan 34 and Nizershail. The lowest number of effective tillers hill^{-1} was observed (6.20) in BRRI dhan 33. However, there was no significant difference between BRRI dhan 33 and Binashail. The effects on total tillers and effective tillers were reflected on non-effective tillers. Number of non-effective tillers hill^{-1} was significantly affected by the varieties (Table 5). The highest number of non-effective tillers hill^{-1} (2.82) was observed in BRRIdhan 33. It was similar to Nizershail (2.74). There was no significant difference between Binashail and BRRI dhan 34 in producing non-effective tillers hill^{-1} but it differed from BRRI dhan 39 (2.28). Varieties also differed significantly in the case of length of panicle (Table 5). The longest panicle (25.14 cm) was recorded in BRRIdhan 34 and the shortest panicle (21.44 cm) was found in BRRI dhan 33, which was statistically identical with BRRI dhan 39 and Nizershail. The intermediate panicle length (23.95 cm) was observed in Binashail. Panicle length of varieties differed due to their differences in genetic make-up. Number of filled grains panicle^{-1} was found different among the five varieties of transplant aman rice. The highest number of filled grains panicle^{-1} (131.4) was observed in BRRIdhan 34 followed by Binashail, BRRIdhan 39, Nizershail and BRRIdhan 33. The lowest number (80.07) of grains panicle^{-1} was observed in BRRIdhan 33. The effects on filled grains panicle^{-1} was reflected on the number of non-filled grains panicle^{-1}. Number of non-filled grains panicle^{-1} was significantly influenced by the varieties (Table 9). The highest number of non-filled grains panicle^{-1}was found in BRRI dhan 34 (22.76) followed by BRRI dhan 39 (17.98). The lowest number of non-filled grains panicle^{-1} was found in Nizershail (15.16). Weight of 1000 grains was also significantly affected by the varieties due to variation in genetic make-up (Table 5). The maximum weight of 1000-grains (22.35 g) was observed in BRRI dhan 39 followed by BRRI dhan 33 (21.28 g). The lowest 1000 grains weight (10.49 g) was found in BRRIdhan 34. Here it is to be noted that variety BRRI dhan 34 was found most competitive in respect of accumulation of weed dry matter, but in producing grain it ranked last but one. The character of competitiveness and the high yield can not always be correlated. All the HYV of rice are characterized by short plant stature with erect leaves for absorption of maximum sunlight. But in the case of competitive variety, the plant should be taller in height and with droopy leaves, which can provide maximum shading to nearby weed plants (Karim, 1999). Karim (1999) in his trials with wheat varieties observed that the highest competitive variety produced the lowest grain yield. However, decision of adoption of rice varieties in the rice production system should consider the long-term effect of weeds in the rice fields. Moreover, the HYV can produce higher yields usually under weed free conditions. Therefore, the cost of weed control in HYV rice and the benefit from greater yield than competitive variety of rice should be considered in selecting the variety for a particular field. Straw yield was significantly influenced due to varieties. The highest straw yield (6.23 t ha^{-1}) was observed in Binashail and the lowest (5.14 t ha^{-1}) in BRRI dhan 33, which was statistically similar to BRRI dhan 39 (5.23 t ha^{-1}), BRRI dhan 34 (5.25 t ha^{-1}) and Nizershail (5.31 t ha^{-1}) (Table 5). Harvest index was significantly influenced by the varieties (Table 5). The highest harvest index was found in BRRI dhan 33 (44.61%), which was statistically similar to BRRI dhan 39 (44.53%). The intermediate harvest index was found in Binashail (38.23%), which was again similar to BRRI dhan 34. The lowest harvest index was recorded in Nizershail (36.56%).

Effects of weeding regimes on yield and yield components: Plant height was significantly influenced by the weeding regimes. Recorded data in different weeding regimes have been presented in Table 6. It was found that the tallest plant (119.8 cm) was obtained from the weed free treatment, which was significantly taller than no weeding (113.6 cm) and one weeding regime (114.0 cm). The shortest plant (113.6 cm) was produced by no weeding regime. No significant differences were observed among weed free, two weeding and three weeding regimes (Table 6). The results are in agreement with that of Ahmed *et al.* (1986) and Mamun (1986). Weed competition was severe in no weeding treatment and thus plant height was reduced by 5%. On the other hand, in weed free condition, competition of weeds with crop plants for growth factors was absent or negligible and thus their height was increased. The number of total tillers hill^{-1} was significantly affected by the weeding regime. The highest number of total tillers hill^{-1} (10.34) was observed in weed free regime, which was significantly higher than no weeding regime (8.66). No weeding regime (8.66) and one weeding regime (8.92) were statistically similar. On the other hand, two weeding regimes (9.31) and three weeding regimes (9.76) was statistically similar (Table 6). These results are in conformity with that of Alam *et al.* (1995); Singh and Singh (1998)). Tillers hill^{-1} increased markedly due to weed free condition. Similar effects were also noticed in the case of number of effective tiller hill^{-1} (Table 6). The highest number of effective tillers hill^{-1} was produced in weed free regime (8.20), which is statistically similar to three weeding regimes. The lowest number (6.03) was observed in no weeding regime, which was identical to one weeding regime (6.36). Result revealed that effective weed management enhanced effective tiller production (Alam *et al.,* 1995). The effects on effective tillers were reflected on the number of non-effective tillers hill^{-1}. Number of non-effective tillers hill^{-1} was influenced due to weeding regime (Table 6). The highest number of non- effective tillers hill^{-1} (3.24) was produced from no weeding regime followed by one weeding (2.61), two weeding (2.14) and three weeding (1.79). Therefore, number of weeding decreased the number of non-effective tillers hill^{-1}. Panicle length was also significantly affected by weeding regimes (Table 6). The longest panicle (23.53cm) was observed in weed free condition, which was statistically identical to three weeding (23.34 cm) and two weeding regimes (22.72 cm). The lowest panicle length (23.34 cm) was observed in no weeding regime, which was again identical to one weeding (22.34 cm). Results revealed that better weed management enhanced panicle length. These results are in conformity with that of Singh (1996). Number of filled grains panicle^{-1} varied significantly due to weeding regimes. The highest number of grains panicle^{-1} (111.5) was recorded in weed free condition, which was identical to three weeding (108.6). The lowest number of grains panicle^{-1} (82.38) was found in no weeding regime. It was differently followed by one weeding (88.43) (Table 6). Therefore it is indicated that the filled grains panicle^{-1} increased with the increment of weeding frequency. Again the effects on number of filled grains panicle^{-1} was reflected on the number of non-filled grain panicle^{-1}. Number of non-filled grains panicle^{-1} was significantly influenced by the weeding regimes (Table 6). Numerically the highest number of non-filled grains panicle^{-1} was recorded in no weeding regime (21.36). It was followed by one weeding (20.50), two weeding (17.43), three weeding (16.11) and weed free condition (14.86). The lowest number of non-filled grains panicle^{-1} was found in weed free condition (14.86), which differed significantly from all other weeding regimes. Similarly, Wayan *et al.* (1982) found the highest non-filled grains panicle^{-1} in no weeding regime. Although the 1000-grain was increased due to more number of weeding, the differences were not significant in this experiment. However, most of the studies revealed that mechanical weeding rendered increased weight of 1000-grains (Singh and Ram, 1991; Hossain and Alam, 1991). The effect of weeding regimes on the number of effective tillers hill^{-1} and number of grains panicle^{-1} was reflected on grain yields. Weeding regime had significant effect on the grain yield of rice. The highest grain yield (4.01 t ha^{-1}) was obtained from weed free regime, which was identical to three weeding regimes (3.95 t ha^{-1}). The lowest grain yield was recorded in no weeding condition (3.42 t ha^{-1}) differently followed by one weeding (3.55 t ha^{-1}). The lowest grain yield in no weeding condition was supported by the lowest number of effective tillers hill^{-1} and the lowest number of grains panicle^{-1} (Table 6). This might be due to severe weed infestation in no weeding that caused higher competition between the weeds and the rice plant for the growth essentials. Chowdhury *et al.* (1995) reported that the weed free regime gave the highest yield than no weeding regime. Straw yield of transplant aman rice was also significantly influenced due to weeding regimes. Straw yield exhibited similar trend as that of grain yields. The highest straw yield (5.83 t ha^{-1}) was obtained from the weed free condition, which was identical to three weeding (5.82 t ha^{-1}). The lowest straw yield (4.94 t ha^{-1}) was recorded in no weeding condition, which was identical to one weeding regime (5.20 t ha^{-1}) (Table 6). Due to no competition of weeds with crop plants in weed free condition, plant height and number of tillers hill^{-1} were increased notably, which were mainly responsible for the increase of straw yield. Similar results were reported by Alam *et al.* (1995). Harvest index was not significantly affected by the weeding regime.

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