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Grain Yield and Yield Attributes of Boro Rice as Affected by Cultivar and Weeding Regime in Haor Area

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An experiment was conducted in the farmers' field in the *haor* of Jawar village of Kishoreganj district, Bangladesh during the period November 1987 to April 1988. Three adjacent fields from three different farmers were taken for the experiment and each field was considered as a replication. Two factors included in the experiment were cultivar and weeding regime. The experiment was laid out in a split plot design where cultivars were assigned in the main plot and weeding regime in the sub plot. Results showed that BR3 produced the highest and Ketchli boro the lowest yield. Other five varieties commonly cultivated in the area yielded in between them and four of them had statistically similar yield. Cultivar and weeding regime interaction indicated that BR3 and Hazisail produced the highest yield under weed-free situation. Farmers' common weeding practice has the scope of further improvement.

Key words: *Boro* rice, *Haor*, Cultivar, Weeding regime.

Introduction

Rice production in recent years has increased considerably in Bangladesh mostly because of adoption of improved varieties and expansion of *boro* (winter) rice areas (Anon 1991). *Haor*, a natural depressed saucer shaped vast area, represents a unique environment for *boro* rice cultivation and produces considerable rice yield. These *haors* become flooded during monsoon and remain under water until winter when water recedes from upper elevation except the central basin making enough area cultivable for *boro* rice. Upon recession of water during October and November the fields are cleared of the aquatic weeds and are kept undisturbed until the optimum water height for the transplantation of the seedlings is reached in the field. The fields are then puddled by country plough and the seedlings are transplanted. In the early stages of crop growth, weeds do not create that much a problem due to presence of sufficient water, but with gradual decrease of water from the field the problem of weed is intensified. Ultimately if the weeds are not controlled properly the spaces between the rice hills are covered by aquatic weeds that create a threat to the crop (Mamun *et al* 1987; Anwar *et al* 1994, 1996). A study at the Bangladesh Rice Research Institute revealed that uncontrolled growth of weeds reduced the yield of *boro* rice cv BR3 by 39% (Anon 1977). Among the major constraints which compel the farmers not to adopt management practices to keep the fields free of weeds include lack of money to hire labour for weeding, preoccupation of the farmers with other business and scarcity of labour at the peak period of weeding (Mamun 1988). It has, however, been observed that a yield loss of 9.88% occurs in *boro* rice due to weeds even though the crops are weeded by the farmers in their conventional manners. However, in *haor* areas, because of different soil elevation, water regime mainly determines the use of *boro* rice cultivars and cultural practices. But, the water regime, rice cultivar and cultural practices, mainly the weeding practices, interact differently among themselves and influence the rice yield. This study was, therefore, undertaken to see the effect of cultivars and weeding regime on the performance of *boro* rice in *haor* area of the north-eastern part of Bangladesh.

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Materials and Methods

The experiment was undertaken in the Jawar village of Kishoreganj district in the Old Brahmaputra floodplain agroecological region under 9e subregion (UNDP/FAO 1988). Soil of the village is noncalcarious grey floodplain type with loamy (35%) to clayey (65%) in texture (Anon 1990). The experiment was conducted in the farmers' field. Three adjacent fields from three different farmers were taken for the experiment. These fields remained submerged under water for six months during monsoon. At the recession of water the fields were cleared of aquatic weeds during the last week of November, 1987 and were left undisturbed. When the water level reached a knee-height, the first ploughing was done on 20 December, 1987. When the water height

reached optimum level for the transplanting of seedlings the second and third ploughing were made. Three ploughings are the usual practice for land preperation for *boro* rice cultivation in the area. The fields were then laid out as per split plot design where each field was considered as a seperate replication. There were two factors in this experiment-cultivar and weeding regime. The cultivars were assigned in the main plot and the weeding regime in the sub plot. Seven cultivars, most commonly used in these areas- BR3, Pajam, Hazisail, Lahya, Madhabsail, Tepi boro and Ketchli boro were used in the experiment. Three weeding regimes- weed free, farmers' weeding practice and unweeding were used. The plots were hand weeded four times at 20, 35, 50 and 65 days after transplanting (DAT) to keep the crop weed free. The treatment, farmers' practice included two times hand weeding at 20 and 35 DAT which is commonly followed by the farmers in these *boro* fields. Size of each unit plot was $15m^2$. Seedlings were transplanted on 15 January 1988 with two seedlings per hill giving a spacing of 25cm line to line and 15cm hill to hill. Triple super phosphate at the rate of 30 kg ha^{-1} was applied as basal and urea at the rate of 20 kg ha^{-1} was top dressed once at 35 DAT. This was the usual fertilizer management practice followed by the farmers for raising *boro* rice in the area. No insecticide was applied and the crop was grown rainfed. Data collected on crop characters at harvest were statistically analysed and the mean differences were adjudged by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Effect of cultivar. BR3, an improved cultivar, produced the highest grain yield of 5937.04 kg ha^{-1}. Its average yield throughout the country is considered 5500-6500 kg ha^{-1} (Anon 1989). The lowest grain yield was produced by Ketchli boro, a local one (Table 1). The highest grain yield production in BR3 can be contributed to its highest panicle bearing tillers per hill, longest panicle and heaviest grains. Production of the lowest grain yield per hectare in Ketchli boro may be contributed to its shortest panicle and fewest fertile grain per panicle. However, though the number of fertile tiller per hill and the weight of 1000 grain were not the lowest in Ketchli boro, they were statistically identical with those of Tepi boro which produced these attributes at the lowest level. The grain yield in Pajam, Madhabsail, Lahya and Tepi boro which were the local cultivars, were statistically identical. More or less similar trend was also observed in case of yield contributing characters of these cultivars.

Effect of weeding regime. Weed free crop produced the highest grain yield per hectare and unweeded crops produced the lowest yield (Table 2). The yield reduction was noticed to be 43%. Mahapatra and Yaduraju (1981) recorded 9-51% yield loss due to weed infestation in irrigated rice depending upon the agroclimatic conditions and methods of cultivation. The highest grain yield in weed free crop was contributed by the production of highest number of fertile grain per panicle and the heaviest grains. The lowest grain yield per hectare in unweeded crop was attributed to the production of lowest number of panicle bearing tiller per hill, shortest panicle, lowest number of fertile grains per panicle and the highest number of sterile grains per panicle. This difference in the production of yield and yiled contributing characters between the weed free and unweeded treatment was obviously attributed to the difference in weed competition in these two treatments. Weed free crop experienced no competition from the weeds whereas the unweeded crop experienced competetions from the associated weeds throughout the crop cycle. The farmers' practice produced grain yield which intermediated weed free and unweeded plots. However, its grain yield per hectare was significantly higher than that of the unweeded crop but significantly lower than that of the weed free crop. Similar trend was also observed in case of yield contributing characters.

Interaction between cultivar and weeding regime. Cultivar and weeding regime interaction indicated that the highest grain yield was produced by BR3 in weed free

Table 1

Effect of cultivar on different crop characters

Cultivar	Plant height (cm)	Total tiller $hill^{-1}$	Panicle bearing tiller $hill^{-1}$	Panicle length (cm)	Number of fertile grain $panicle^{-1}$	Number of sterile grain $panicle^{-1}$	1000 grain weight (g)	Yield (kg ha^{-1})
BR3	74.25d	18.19a	13.48a	20.75a	64.37b	24.07bc	28.08a	5937.04a
Hazisail	86.53cd	13.49b	9.82b	18.89b	88.34a	33.31a	20.02cd	5441.09a
Pajam	96.61bc	11.23bc	8.62b	19.47b	74.50ab	26.54ab	16.35d	4101.46b
Lahya	114.81a	9.85bc	7.77b	19.90ab	67.21b	13.89c	21.59c	3229.59b
Madhabsail	111.49a	10.37bc	8.32b	19.36b	69.38b	6.68c	25.36b	4140.36b
Tepi boro	117.57a	9.06c	7.48b	18.98b	72.33ab	17.45bc	21.64c	3980.07b
Ketchli boro	107.40ab	11.07bc	8.42b	16.64c	35.57c	14.90c	18.50d	1907.70c

Table 2

Effect of weeding regime on different crop characters

Weeding regime	Plant height (cm)	Total tiller hill^{-1}	Panicle bearing tiller hill^{-1}	Panicle length (cm)	Number of fertile grain panicle^{-1}	Number of sterile grain panicle^{-1}	1000 grain weight (g)	Yield (kg ha^{-1})
Weed free	104.69a (+9)*	13.10a (+29)	10.38a (+35)	19.92a (+6)	78.77a (+40)	20.23 (-2)	22.17a (+4)	4953.89a (+43)
Farmers' practice	102.61a (+6)	12.41a (+22)	9.27b (+21)	18.80b (+3)	67.03b (+19)	17.66 (-15)	21.40b (0)	3891.86b (+12)
Unweeded (check)	96.40b	10.17b	7.69c	18.27b	56.35c	20.72	21.38b	3470.23c

* Values in parenthesis indicate percent increase or decrease compared with unweeded treatment.

Table 3

Effect of cultivar and weeding regime interaction on different crop characters

Cultivar	Plant height (cm)	Total tiller hill^{-1}	Panicle bearing tiller hill^{-1}	Panicle length (cm)	Number of fertile grain panicle^{-1}	Number of sterile grain panicle^{-1}	1000 grain weight (g)
				Weed free			
BR3	77.49e	21.05a	15.92a	21.13	63.93b	25.71	28.38
Hazisail	90.62d	15.27b	11.72c	19.32	92.27ab	38.33	20.44
Pajam	96.42cd	11.37cd	9.10d	20.73	103.40b	30.61	16.66
Lahya	120.13a	10.82cd	8.93de	20.72	74.80b	11.84	22.18
Madhabsail	119.27a	12.30c	10.32cd	20.38	86.61ab	6.58	25.79
Tepi boro	118.98a	9.60cd	7.95de	18.81	93.09ab	14.63	22.07
Ketchli boro	109.95b	11.32cd	9.05d	17.37	37.56c	14.48	19.66
				Farmers' practice			
BR3	75.29e	19.78a	14.08b	20.82	67.59b	20.56	28.05
Hazisail	88.69d	14.90b	10.68c	18.98	102.02a	33.39	19.76
Pajam	98.33c	11.37cd	8.43de	18.95	64.85b	26.61	16.23
Lahya	115.69ab	9.85cd	7.57de	19.67	71.32b	14.09	21.08
Madhabsail	116.25a	11.38cd	8.43de	18.91	63.34b	6.45	25.13
Tepi boro	117.48a	8.55e	7.38e	18.43	65.09b	8.21	21.65
Ketchli boro	106.37b	11.05cd	8.33de	16.25	35.00c	14.33	17.90
				Unweeded (check)			
BR3	69.97f	13.73b	10.45cd	20.30	61.58a	25.94	27.82
Hazisail	80.29e	10.32cd	7.05e	18.38	70.98b	27.90	19.87
Pajam	94.87cd	10.97cd	8.32de	18.72	55.27bc	23.01	16.16
Lahya	108.62b	8.90e	6.80e	16.73	55.50bc	15.75	21.50
Madhabsail	98.94c	7.41e	6.20e	18.78	58.19b	7.01	25.16
Tepi boro	116.27a	9.03d	7.11e	18.70	58.80b	29.50	21.18
Ketchli boro	105.88b	10.85cd	7.87de	16.30	34.14c	15.90	17.94

condition and the lowest grain was produced by Ketchli boro also in weed free condition (Fig 1). However, the grain yield of Ketchli boro at weed free condition was statistically identical with that in unweeded condition. The highest grain yield in BR3 at weed free treatment was contributed by the production of highest number of fertile tiller per hill, longest panicle and heaviest grain; number of total tiller was also the highest in the cultivar at this treatment (Table 3). In the cultivars BR3 and Hazisail the grain yield in each of the weeding frequency differed significantly to each other. In cultivars Pajam and Madhabsailthe grain yield in weed free and farmers' practice also differed significantly but the difference between the farmers' practice and no weeding was not significant. However, in other cultivars i.e. Lahya, Tepi boro and Ketchli boro grain yields were statistically identical irrespective of weeding regime indicating that these short duration local varieties have very little or no response to weed infestation in these water stagnant *boro* fields. A significant difference between the grain yield of weed free and farmers' practice treatments in the cultivars BR3, Hazisail, Pajam and Madhabsail suggested that the conventional weeding practices adopted by the farmers were not efficient enough to save the crop from weed competition.

BR3, Hazisail, Pajam and Madhabsail were most sensitive to weed infestation while Lahya, Tepi boro and Ketchli boro were the least sensitive. Under situations where no management practices of weeding are possible better yield can be anticipated by growing these short statured local varieties. But higher yields will be obtained by growing BR3, Hazisail, Pajam and Madhabsail provided improved management practices are employed to keep the fields weed free.

Thus from the study it may be concluded that crop weeded by the farmers' practice is not sufficient for keeping the weed infestation level equivalent to that in weed free crop. So, it is suggested that the weed control technology as used by the farmers in *boro* rice in this area has the scope of further improvement.

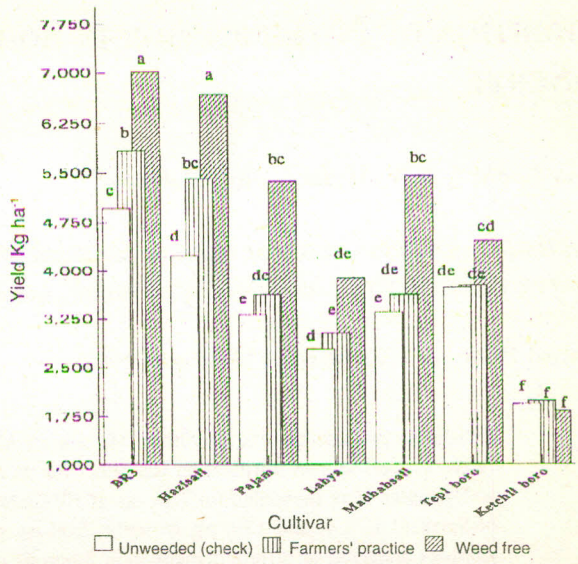

Fig 1. Grain yield of *boro* rice as affected by cultivar and weeding regime.

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