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Effect of Pre-flowering Leaf Cutting on Forage and Seed Yield of Transplant Aman Rice

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Abstract: The possibility of extent usage of rice for human and livestock simultaneously was studied. The experiment consisted of four varieties namely Latishail, BR10, BR11 and BRRIdhan32 and four leaf cuttings viz., no leaf cutting(T_1), leaf cutting at 21 DAT(T_2), leaf cutting at 28 DAT(T_3), leaf cutting at 35 DAT(T_4). The effect of leaf cutting was significant on growth parameters namely plant height, total number of tillers and leaves hill^{-1} at different days after transplanting. In respect of all studied varieties, the highest plant height, total tillers hill^{-1}, productive tillers hill^{-1} , non bearing tillers hill^{-1} , panicle length, grains panicle^{-1}, sterile spikelets panicle^{-1},grain yield, straw yield, cumulative straw yield, biological yield and harvest index were obtained in no leaf cutting (control). The yield and yield contributing characters decreased by leaf cutting as compared to control. The results revealed that among the varieties and the different leaf cutting treatments, Latishail leaf cutting at 35 DAT gave the significantly higher forage yield. The highest grain yield was obtained in no leaf cutting which was statistically identical to leaf cutting at 21 and 28 DAT. It may be concluded that leaf cutting at early stage of crop growth could produce almost similar grain or seed yield of control crops with the additional forage yield.

Key words: Rice, seed, forage, dry matter, leaf cutting

Introduction

The economy of Bangladesh is agriculture based, so general welfare of the country is largely dependent on sound development of agriculture. Population is sharply increasing, creating more pressure on agriculture to produce more food, animal protein and livestock feed. Food-cum forage crop like rice, seems to be one of the most feasible and economically viable practices to serve the needs of human food, cash income and animal feed, particularly for those with limited resources (Topark-Ngram *et al.*, 1988). Rice straw is the staple feed for the livestock, but this straw is not sufficient for livestock population during August – October (before harvesting aman rice) when entire fields are occupied by wet land rice. Moreover there is a severe crisis of green feed during this lean period. The only livestock feed supply in nutritionally poor as well as least in quantity. As a result, animals lose about 15-20% body weight during this period (Saadullah, 1995). They suffer from weak health when their maximum drought power becomes essential viz., transporting harvested aus rice, jute, land preparation for rabi crop etc. The farmers of Bangladesh are not interested to grow forage crop in their land because most of the farmers are small holders and they cannot afford to use their land for fodder instead of food crop. Only the duel-purpose rice crop production may be beneficial to the animal production system with instant supply of forage to all categories of livestock due to its succulent consistency and palatability as well as grains for human consumption or seed production. Usually, excess leaf growth of long duration rice plants is grazed at the early vegetative stage. In some deep water areas of Bangladesh, Badal, a traditional deep water rice variety is grown as fodder (Magor, 1986). Cutting long duration rice leaves at the vegetative phase is also practiced in India (Copeland, 1972) and is now more frequently done in Thailand (Kupkanchanakul *et al.*, 1991). If leaf cutting really has no effect on the production of grains, it may become one of the most economical ways of increasing the yield, with the added advantage that it will provide the farmers with green feeding materials for their work animals. The success of rice cultivation as dual purpose is mostly dependent on different improved agronomic techniques and cutting time. Time of cutting rice leaves and selection of suitable variety seems to be very important for obtaining enough forage without sacrificing grain yield. The present experiment was therefore, undertaken with the objectives to determine the effects of time of leaf cutting on the forage and grain yield of transplant aman rice and to determine the effect of leaf cutting on different varieties of transplant aman rice.

Materials and Methods

The experiment was conducted at Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from June to December, 1999.The experiment consisted of four varieties of rice namely Latishail, BR10, BR11 and BRRIdhan32 and four leaf cutting times viz., no leaf cutting (T_1), leaf cutting at 21 DAT (T_2), leaf cutting at 28 DAT (T_3) and leaf cutting at 35 DAT (T_4). The experiment was laid out in a split-plot design with four replications assigning variety in main plot and leaf cutting in sub-plot. The size of each unit plot was 4.0 m x 2.5 m (10.0 m^2). Thirty two days old seedlings of all the varieties were transplanted on 25 July 1999 maintaining 25 cm x 15 cm spacing and at the rate of 3 seedlings hill^{-1}. Leaf cutting was made at the height of about 15 cm above soil level at different dates as per experimental specifications. Data on different plant characters and yield components of before and after harvest were collected from ten randomly selected sample plants from each plot. Analysis of variance was done with the help of computer package MSTAT. The mean differences among the treatments were adjudged as per tested with Duncan's New Multiple Range test (Steel and Torrie, 1980).

Results and Discussion

The variety showed significant effect on all growth parameters except number of tillers hill^{-1} (at all dates of observations) and total number of leaves hill^{-1} (at 42 and 49 DAT observations). The highest plant height was obtained in Latishail and the lowest was found in BR10 at all dates of observations (Table 1). Similar results were also found by Hossain and Alam (1991), BINA (1993) and Kamal *et al.* (1988), that height of plant differed due to variety. The highest value of tillers and leaves hill^{-1} were

Table 1: Effect of variety and leaf cutting on plant height and number of total tillers hill^{-1}

Treatments	Plant height (cm)					Number of tillers hill^{-1}				
	28 DAT	35 DAT	42 DAT	49 DAT	At maturity	28 DAT	35 DAT	42 DAT	49 DAT	At maturity
Variety										
Latishail(V_1)	58.77a	61.06a	63.01a	70.17a	127.21a	10.53	11.91	12.59	13.13	10.62
BR10(V_2)	51.11b	54.31c	56.53b	64.15b	112.99b	10.69	11.74	12.19	12.60	10.39
BR11(V_3)	53.25b	56.64b	57.92b	65.55b	117.33b	11.06	12.27	12.49	13.06	10.66
BRRIdhan32(V_4)	51.51b	55.00bc	57.85b	65.21b	115.68ab	10.82	11.73	12.21	12.80	9.66
Leaf cutting										
Control/no leaf cutting(T_1)	56.17a	63.76a	71.57a	77.48a	124.07a	11.23a	12.51a	13.05a	13.97a	11.30a
Leaf cutting at 21 DAT(T_2)	46.69b	53.28b	61.57b	68.45b	120.49ab	9.46b	10.98b	12.06bc	12.65b	10.59a
Leaf cutting at 28 DAT(T_3)	55.97a	45.96c	55.37c	62.48c	116.38bc	11.27a	11.43b	11.64c	12.23b	10.39a
Leaf cutting at 35 DAT(T_4)	55.81a	64.02a	46.81d	56.67d	112.27c	11.14a	12.73a	12.73ab	12.73b	8.83b

In a column, figures bearing same or no letter(s) do not differ significantly at 5% level of significance, according to DMRT.

Table 2: Effect of variety and leaf cutting on number of total leaves hill^{-1}, forage yield and dry matter yield

Treatments	Number of total leaves hill^{-1}					Forage yield (t ha^{-1})	Dry matter yield (t ha^{-1})
	28 DAT	35 DAT	42 DAT	49 DAT	At maturity		
Variety							
Latishail(V_1)	43.94a	46.28a	49.06	51.17	42.91a	1.37a	0.32a
BR10(V_2)	38.62b	46.67ab	48.84	51.17	38.21b	1.10b	0.27b
BR11(V_3)	39.62b	44.58ab	48.39	51.65	39.19b	1.22ab	0.29ab
BRRIdhan32(V_4)	38.21b	42.45b	47.18	50.20	37.88b	1.19ab	0.30ab
Leaf cutting							
Control/no leaf cutting(T_1)	45.84a	55.11a	58.80a	60.57a	45.28a	-	-
Leaf cutting at 21 DAT(T_2)	22.72b	32.30c	42.30c	45.74c	40.94b	1.01c	0.22c
Leaf cutting at 28 DAT(T_3)	46.12a	35.38b	45.56b	28.26b	38.03c	1.47b	0.35b
Leaf cutting at 35 DAT(T_4)	45.71a	55.19a	46.79b	49.64b	33.93d	2.40a	0.62a

In a column, figures bearing same or no letter(s) do not differ significantly at 5% level of significance, according to DMRT.

Table 3: Effect of variety and leaf cutting on different crop characters of transplant aman rice

Treatments	No. of productive tillers hill^{-1}	No. of non-bearing tillers hill^{-1}	Panicle length (cm)	No. of grains panicle^{-1}	No. of sterile spikelets panicle^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biologic-al yield (t ha^{-1})	Harvest index (%)
Variety										
Latishail(V_1)	8.78	1.84bc	20.24c	60.59b	11.06c	25.09a	3.61c	6.03a	9.63b	37.42b
BR10(V_2)	8.31	2.08b	23.05ab	95.15a	17.18b	21.62b	4.63a	5.33bc	9.98ab	46.64a
BR11(V_3)	8.10	2.56a	22.61b	97.21a	17.75b	22.12b	4.81a	5.42b	10.17a	46.80a
BRRIdhan32(V_4)	8.19	1.48c	23.99a	93.97a	19.31a	20.10c	4.16b	4.99c	9.14c	45.39a
Leaf cutting										
Control/no leaf cutting(T_1)	9.19a	2.12a	23.52a	92.69a	18.68a	22.72	4.71a	5.60a	10.31a	45.59a
Leaf cutting at 21 DAT(T_2)	8.58ab	2.01ab	23.09ab	87.99b	17.13b	22.21	4.44a	5.51bc	9.95ab	44.64a
Leaf cutting at 28 DAT(T_3)	8.16b	2.23a	21.85bc	86.15b	15.56c	22.11	4.41a	5.41b	9.82b	44.89a
Leaf cutting at 35 DAT(T_4)	7.25c	1.59b	21.42c	80.09c	13.94d	21.88	3.64b	5.23c	8.87c	40.97b

In a column, figures bearing same or no letter(s) do not differ significantly at 5% level of significance, according to DMRT.

found in BR11 (except observations at 42 and 49 DAT) and Latishail, respectively at all the sampling dates (Table 1&2). These observations are in the agreement with the findings of Ahmed (1999). Results indicated that leaf cutting treatment showed significant effect on all growth parameters at all the sampling dates. The highest value of plant height was obtained from no leaf cutting treatment at all the observation dates. The lowest value of plant height was recorded for 28, 34, 42, 49 DAT and at maturity when the leaf cutting was done at 21, 28, 35, 35 and 35 DAT, respectively (Table 1). Similar results were also found by Roy and Pradhan (1992). The highest value of number of total tillers hill^{-1} for observations at 28, 35, 42, 48 DAT and at maturity were obtained in control and the lowest at the same date of observations were obtained when leaf cutting was done at 21, 21, 28, 28 and 35 DAT, respectively (Table 1). These results are in full compliance with those of Hachiya (1989). At 28, 35, 42, 49 DAT and maturity, the highest value of number of total leaves hill^{-1} were obtained from control (Table 2).

The forage and dry matter yield were significantly influenced by varieties. Latishail was superior to all other studied varieties in respect of forage and dry matter yield (Table 2). The highest forage (1.37 t ha^{-1}) and dry matter yield (0.32 t ha^{-1}) were obtained in Latishail. While lowest forage (1.10 t ha^{-1}) and corresponding dry matter yield were obtained in BR10. Malik *et al.* (1992) observed differences in forage yield among the varieties. The forage and dry matter yield in different leaf cutting treatments varied significantly. Forage yield in leaf cutting at 35 DAT was 2.40 t ha^{-1} while that was only 1.01 and 1.47 t ha^{-1} in leaf cutting at 21 and 28 DAT, respectively (Table 2). The dry matter yield was 0.62 t ha^{-1} in leaf cutting at 35 DAT and that was 0.22 and 0.35 t ha^{-1} in leaf cutting at 21 and 28 DAT.

The varieties showed significant variations on plant height, non-bearing tillers hill^{-1}, panicle length, sterile spikelets panicle^{-1}, grain yield, straw yield, biological yield, total straw yield and harvest index. BINA (1993) stated that number of non-bearing tillers hill^{-1} was significantly influenced by varieties.

Mannan (1996) stated that panicle length differed among the varieties. In respect of modern varieties, the highest grains panicle^{-1} (97.21), 1000-grain weight (22.11g), grain

yield (4.84 t ha^{-1}) biological yield (10.16 t ha^{-1}) and harvest index (46.80%) were observed in BR11 as compared to BR10 and BRRIdhan32 (Table 3). Hossain and Alam (1991) reported variable number of grains $panicle^{-1}$ among the varieties.The highest 1000-grain (25.09 g) weight was found in Latishail. Again, Latishail produced the lowest panicle length (20.24 cm), sterile spikelets (11.06) grains $panicle^{-1}$(60.59), grain yield (3.60 t ha^{-1}) and harvest index (37.32).

The effect of leaf cutting was found to be significant in respect of the crop characters except 1000-grain weight. The highest value of productive tillers $hill^{-1}$(9.19), panicle length (23.52 cm), sterile spikelets (18.68) grains $panicle^{-1}$ (92.69), 1000-grain weight (22.72 g), grain yield (4.71 t ha^{-1}), straw yield (5.60 t ha^{-1}), biological yield (10.31 t ha^{-1}) and harvest index (45.59%) were found in control. Ghosh and Sharma (1998) reported higher number of grains $panicle^{-1}$ from early leaf cutting than late leaf cutting. The lowest value for all crop characters were observed when the leaf was cut at 35 DAT (Table 3). Bardhan and Mondal (1988) observed that panicle length decreased due to leaf cutting. It is concluded that increasing day of leaf cutting gradually decrease the panicle length. Das and Mukherjee (1992) reported that late leaf cutting reduce the grain yield and this was also true for present experiment.

From the scope and limitation of present experiment, it may be concluded that leaf cutting at early stage (leaf cutting at 28 DAT for studied modern varieties and 35 DAT for Latishail) of crop growth could produce almost similar grain or seed yield of control crops with the additional forage yield.

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