http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 4 (2): 156-158, 2001

Effect of Different Clipping Heights on the Green Fodder, Hay and Seed Production of Four Cultivars of Transplant Amen Rice

[1]M. Ahmed, [1]M.S.H. Molla and [2]A.H.M. Razzaque
[1]Department of Agronomy, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[2]Crop Physiology Div., Bangladesh Institute of Nuclear Agriculture, Mymensingh-2200, Bangladesh

Abstract: The objective of this study was to see if it is possible to grow rice as a duel purpose crop i.e., as a source of green fodder and seed/grain. Results obtained from the experiment involving (a) four leaf clipping heights viz. 10, 15, 20 cm and control (no clipping) and (b) four cultivars of rice viz. Latishail, BR10, BR11 and BRRIdhan32 revealed that green fodder yield decreased with the increase in height of leaf clipping. The lowest and highest green fodder yield were obtained from 20 and 10 cm clipping height, respectively. The identically highest green fodder yields were found by cultivars Latishail and BR11, respectively and the lowest by BRRIdhan 32. Plant height was positively related to leaf clipping height. The highest and lowest plant heights at harvest were found in control (no clipping) and 10 cm clipping treatments, respectively. Hay yield and seed yield decreased with the decrease in height of leaf clipping. The lowest and highest yields of both hay and seed were obtained from 10 cm clipping height and control (no clipping), respectively. Clipping at 20 cm was statistically identical with control (no clipping) in respect of hay and seed yield. The highest hay and seed yields were found by cultivar BR11. It is possible to harvest rice green fodder from transplant aman rice like BR11 and the height of leaf clipping may be up to 20 cm at vegetative growth stage.

Key words: Rice, Duel purpose crop, Green fodder, Hay, Cumulative yield

Introduction

Rice is the staple food in Bangladesh and most of the Asian countries. Agriculture is characterized here by intensive crop production with the rice based cropping systems. Bangladesh earns about 38% of her gross domestic product (GDP) from agriculture (BBS, 1997). Majority of her people depends on agriculture. Crop production in Bangladesh is very much dependent on livestock which provide most of the draught power for land preparation. There are a large number of livestock in government, non-government and private farms and peoples own houses, but during the rainy season the country faces scarcity of feed for livestock. In Bangladesh, besides green grasses, livestock mainly live on paddy hay. Bangladesh is one of the most densely populated countries of the world. Majority of the people depends on rice and derives most of their calories from it. So, there is no room for cultivation of fodder crop in lieu of rice. For the same reason, it becomes a burning necessity for us to explore the possibilities of obtaining green fodder and seed from the same pieces of land without decreasing the total yield. Kupkanchanakul and Roontun (1989) reported that In Thailand, it is possible to harvest rice herbage from deep-water rice varieties for animal feed without decreasing the grain yield. Crop yield depends on many factors, such as, light, water and nutrients. The availability of these inputs for the plant may be influenced by cultivar and cultivation practices. It is possible that varietal differences in the crop with respect to yield may be due to differences of leaf sizes. The number of leaves varies from cultivar to cultivar. BRRI (1991) evaluated that different plant characters differed among the cultivars, for example plant height, leaf size, total tillers hill^{-1} and the number of spikelets panicle^{-1} differed significantly among BR3, BR11, BR14, Pejam and Jagali cultivars. Moreover, agronomic treatments, such as, leaf clipping can change the micro environment by changing the morphology and physiology of the crop plants thereby influencing the yield and its components, BRRI (1989) reported that, after flooding, the extra fodder obtained from leaf cutting without seriously affecting the grain yield may be a potential practice for crop livestock mixed farming in the country, particularly in the deep water aman area. There is no much evidence about the possibility of utilizing the leafs from the transplant aman rice which is the major rice crop in the country.

Therefore, the present study was conducted with the following objectives:

1 To find out the effect of different leaf clipping heights on green fodder, hay and seed production of transplant amen rice
2 To determine the optimum leaf clipping height by which green fodder can be exploited without affecting the rice seed yield
3 To identify better cultivar (among the cultivars used) for maximum seed, green fodder and hay production
4 To determine the interaction effect between clipping height and cultivar on green fodder, hay and seed production of transplant aman rice

Materials and Methods

The experiment was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, during the period from July to December, 1999. The experiment comprised of four cultivars, namely, Latishail, BRIO, BR11 and BRRIdhan32 and four leaf clipping heights viz., clipping at 10 cm, clipping at 15 cm, clipping at 20 cm and control (no clipping). The experiment was laid out in a split plot design with four replications. The size of each unit plot was 10 m^2 (4.0 m $\times$ 2.5 m). Cultivar and leaf clipping height were arranged in main and sub plots, respectively. Seedlings of 32 days old were transplanted on 25 July 1999, maintaining the spacing of 20 cm $\times$ 15 cm. The clipping of leaves was done after 30 days after transplanting (DAT) on 24 August 1999. In the clipped plot, rice leaves were removed at different heights viz. 10, 15 and 20 cm and control (no

clipping) which were measured from the ground level, once during the vegetative growth stage. Standard cultural practices were followed as and when necessary. Green fodder, hay and seed yield and yield components under different leaf clipping height were measured from randomly selected 10 hills of each plot. An analysis of variance and an F-test were conducted for each of the tested parameters, followed by Duncan's New Multiple Range Test.

Results and Discussion

Cultivars differed markedly among themselves regarding plant height. Cultivar BR10 produced shorter plants at a particular leaf clipping height in comparison to Latishail, BR11 and BRRIdhan32 and Latishail produced the tallest plants (Table 1). All the cultivars produced shorter plants as clipping height decreased (Table 1).

Cultivar BRIO produced less tillers and leaves hill^{-1} and Latishail produced more tillers and leaves hill^{-1} (Table 1). Cultivar BR11 and BRRIdhan32 were intermediate in producing tillers and leaves hill^{-1}. Plant height and tiller productions were markedly reduced when clipping was done to a height of 10 cm (Table 1). All the cultivars in control (no clipping) treatment performed better in respect of plant height and tiller production. Bardhan *et al*. (1988) noted that leaf removal significantly decreased plant height at maturity. Hachiya (1989) also reported that leaf cutting reduced the number of tillers. All cuttivars produced the highest number of leaves hill^{-1} by leaf clipping at 20 cm and lowest at 15 cm (Table 1).

All other crop characters were significantly influenced by the cuttivars. The response of BR10, BR11 and BRRIdhan32 in respect of number of total spikelets and seeds panicle^{-1} were similar (Table 1). Significantly lowest number of total spikelets (66.28) and seeds (50.65) were produced by Latishail (Table 1). The higher number of total spikelets panicle^{-1} were produced by BRRIdhan32 (102.0) and seeds panicle^{-1} were produced by BR10 (80.72). The highest panicle length and sterile spikelets panicle were produced by BRRIdhan32 and the lowest by Latishail which were statistically similar to BR10 and BR11 (Table 1). The lowest sterility (17.14%) was found in BR10 and highest in Latishail (24.07). The 1000-seed weight, green fodder yield and dry fodder yield were significantly highest in Latishail and lowest in BRRIdhan32 (Table 1, 2). Latishail produced the highest number of effective tillers hill^{-1} (8.67) but lowest in seed yield, hay yield, biological yield, total biological yield and harvest index (Table 1, 2). Cultivar BRIO produced lowest number of effective tillers (7.07) and non-effective (0.76) tillers hill^{-1} and moderate in respect of other characters. The seed yield (4.23 t ha^{-1}), hay yield (5.36 t ha^{-1}), cumulative hay yield (5.84 t ha^{-1}), biological yield (9.56 t ha^{-1}) and total biological yield (10.07 t ha^{-1}) were significantly higher in BR11 and lower in Latishail though only the lowest cumulative hay yield (5.13 t ha^{-1}) was produced by BRRIdhan32 (Table 2). BRRIdhan32 also produced the lowest 1000-seed weight, green fodder yield and dry fodder yield but recorded the highest in non-effective tillers and harvest index (Table 1, 2).

Table 1: Effect of cultivars and leaf clipping heights on different plant and yield contributing characters of transplant Amen 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 leaves hill^{-1}	Green fodder yield (t ha^{-1})	Dry fodder yield (t ha^{-1})	Panicle length (cm)	No. of total spikelets panicle^{-1}	No. of seeds panicle^{-1}
Cultivars										
Latishail (C_1)	123.05a	9.87a	8.67a	1.20a	55.30a	1.98a	0.58a	20.16c	66.28b	50.65b
BR10 (C_2)	110.82c	7.77b	7.07b	0.76b	31.81b	1.95a	0.53ab	22.38ab	97.63a	80.72a
BR11 (C_3)	113.40bc	8.93ab	7.88ab	1.05a	32.43b	1.70ab	0.49ab	21.30bc	92.23a	75.52a
BRRIdhan32 (C_4)	114.46b	8.87ab	7.64b	1.24a	33.99b	1.45b	0.43b	23.09 a	102.00a	77.18a
Leaf clipping heights										
Clipping at 10 cm (H_1)	110.28c	8.20c	7.28c	0.92b	37.46	2.88a	0.80a	21.50b	81.94c	64.29c
Clipping at 15 cm (H_2)	112.69bc	8.60bc	7.54bc	1.06b	38.69	2.37b	0.68b	21.32 b	86.67 bc	68.18 bc
Clipping at 20 cm (H_3)	115.13b	9.02b	8.06ab	0.96b	40.37	1.83c	0.55c	21.73b	91.91ab	73.56ab
Control (no clipping) (H_4)	123.63a	9.62a	8.37a	1.31a	39.01	-	-	22.37a	97.61a	78.04a

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 cultivars and leaf clipping heights on yield and yield contributing characters of transplant Amen rice

Treatments	No. of sterile spikelets panicle^{-1}	Sterility %	1000-seed weight (g)	Seed yield (t ha^{-1})	Hay yield (t ha^{-1})	Cumulative Hay yield (t ha^{-1})	Biological yield (t ha^{-1})	Total Biological yield (t ha^{-1})	Harvest index
Cultivars									
Latishail (C_1)	15.88b	24.07a	25.03a	3.05c	4.61b	5.20b	7.66c	8.25c	39.70b
BR10 (C_2)	16.87b	17.14b	21.23b	4.01ab	5.04ab	5.57ab	9.05ab	9.58ab	44.25a
BR11 (C_3)	16.66b	18.25b	21.64b	4.23a	5.36a	5.84a	9.59a	10.07a	44.11a
BRRIdhan32 (C_4)	24.80a	23.44a	19.45c	3.76b	4.70b	5.13b	8.86bc	8.88bc	44.40a
Leaf clipping heights									
Clipping at 10 cm (H_1)	17.61	21.68	21.55c	3.04c	4.15c	4.95c	7.19c	7.99c	42.01b
Clipping at 15 cm (H_2)	18.48	21.45	21.76bc	3.48b	4.64b	5.32bc	8.12b	8.80b	42.93ab
Clipping at 20 cm (H_3)	18.60	20.28	21.92ab	4.17a	5.30a	5.85a	9.46a	10.01a	43.92a
Control(no clipping) (H_4)	19.52	19.53	22.12a	4.36a	5.62a	5.62ab	9.99a	9.99a	43.60a

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

Table 3: Percentage of cumulative plant moisture loss of green fodder of four cultivars of transplant aman rice at different times from start

Cuttings	After 0 hr	After 1 hr	After 2 hrs	After 3 hrs	After 4 hrs	After 5 hrs	After 6 hrs	After 24 hrs	After 48 hrs	After 72 hrs
Latlehail (C_1)	0	3.65	6.90	8.87	10.91	14.91	18.46	30.19	40.28	50.91
BR10 (C_2)	0	10.69	12.32	14.52	16.13	20.27	25.00	37.10	46.32	55.91
BR11 (C_3)	0	9.56	12.12	14.23	15.61	20.81	25.52	36.09	44.92	54.91
BRRIdhan32 (C_4)	0	5.98	12.48	14.01	15.37	19.51	23.28	35.30	43.59	53.44

The highest cumulative moisture loss of green fodder were found to be (25.52%) after 6 hours of clipping the leaves and afterwards the loss of moisture continued and after 72 hours the percentage of cumulative moisture loss was between 50.91 and 55.91% depending on cultivars used in the experiment (Table 3). The green fodder received by leaf clipping from four cultivars like Latishail, BR10, BR11 and BRRIdhan32 were very liked by farm animals as feed. Significant variation was observed due to the leaf clipping in all the yield and yield contributing characters. When clipping was not done all the characters showed the highest results except for the sterility perceptage, cumulative hay yield, total biological yield, green fodder yield, dry fodder yield and harvest index. Harvest index were noticed to be the highest in clipping at 20 cm while the sterility percentage, green fodder yield and dry fodder yield were produced the highest in clipping at 10 cm (Table 1, 2).The result of the experiment was similar to Kupkanchanakul and Roontun (1989) who found that leaf removal in deep water rice at vegetative stage did not itnificantly affect yield components and on the average, harvest index was improved by cutting. Again, clipping at 10 ais showed the lowest result except for the sterility percentage, panicle length, green fodder yield and dry fodder yield. The 10 cm clipping produced 2.88 t ha^{-1},15 cm clipping produced 2.37 t ha^{-1} and 20 clipping produced 1.83 t ha^{-1} of green fodder (Table 1). Leaf clipping in rice at 20 cm height at vegetative stage (30 DAT) did not significantly affect seed yield. But clipping of aman rice leaves tended to decrease seed yield which was associated with the decrease in seed $panicle^{-1}$, panicle length, total tillers $hill^{-1}$ and 1000-seed weight. Supachai and Prayote (1988) from Thailand who reported similar results with deep water rice in acid sulphate soil. They stated that leaf cutting tended to decrease spikelet number $panicle^{-1}$ which was associated with the decrease in seed yield. The result of the present experiment and the results from other workers (Dann, 1968) confirmed that 1000-seed weight was the major yield component reduced by clipping at vegetative stage.

The interaction of cultivar and leaf clipping height exhibited significant variation on plant height, number of tillers $hill^{-1}$, number of non-effective tillers $hill^{-1}$, green fodder yield, dry fodder yield and vigour index.

Finally, it may be concluded that during the amen season in the flood affected area in Bangladesh when green fodder availability is minimum, it is possible to get rice seed/grain and can harvest leaves from transplant amen rice, like, Latishail and BR11 to use as green fodder and the leaf clipping height may be up to 20 cm at vegetative growth stage.

References

BBS., 1997. Statistical Year Book for 1996. Bangladesh Bureau of Statistics, Bangladesh, Pages: 734.

BRRI., 1989. To get foliage from deep water aman rice without affecting total yield. BRRI Annual Report, pp: 121.

BRRI., 1991. Annual report for 1988. Bangladesh Rice Research Institute, Joydebpur, Gazipur, Bangladesh, pp: 8-15.

Bardhan, S.K., B. Banerji, C. Kundu and B.K. Mondal, 1988. Preliminary study on the effect of leaf cutting for herbage production in deep water rice. A Technical Paper. Rice Research Station, Chinsurah, West Bengal.

Dann, P.R., 1968. Effect of clipping on yield of wheat. Aust. J. Exp. Argic. Anim. Husbandry, 8: 731-735.

Hachiya, K., 1989. Effect of artificial leaf cutting on the growth and yield of rice plants in Hokkaido. Jpn. J. Applied Entomol. Zool., 33: 51-56.

Kupkanchanakul, T. and S. Roontun, 1989. Herbage production from deep water rice crop under farmer condition. Int. Rice Res. Newslett., 15: 17-18.

Supachai, T. and C. Prayote, 1988. Field Trial on Herbage Production in Acid Sulphate Deep Water Area. Prachinburi Rice Research Centre, Prachinburi, Thailan.