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# Effect of Leaf Clipping on Plant Growth and Green Fodder Yield of Different Cultivars of Transplant Aman Rice

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**Abstract:** An experiment was conducted to ascertain the feasibility of green fodder harvest without affecting the seed yield of transplant aman rice. Plant height, number of leaves hill$^{-1}$, number of tillers hill$^{-1}$, green fodder yield and seed yield were significantly differed due to different cultivar and leaf clipping height. Latishail produced the highest plant height, number of leaves hill$^{-1}$ and number of tillers hill$^{-1}$ at all growth stages where BR10 showed the lowest among cultivars. The green fodder yield was also obtained highest (1.98 t ha$^{-1}$) from latishail, which was statistically identical with BR10 and BR11. The highest seed yield (4.23 t ha$^{-1}$) was obtained from BR11, which was followed by BR10 (4.01 t ha$^{-1}$). The highest value of all parameters except seed yield were obtained from control plot at all growth stage where the lowest were recorded from clopping at 10 cm height. The plants clipped at 20 cm height, produced an average green fodder yield in addition to higher seed yield which was statistically similar to control. So it is possible to get green fodder by leaf clipping without seriously affecting the rice seed yield.

**Key words:** Cultivar, green fodder, leaf clipping, plant growth, seed, T. aman rice

## Introduction

To attain self-sufficiency in food and green fodder production, increasing agricultural production per unit area of the limited cultivable land is becoming most important step to cope with the present population growth in Bangladesh.

Rice is considered to be the most important and leading food crop in the world from the standpoint of energy, which it contributes. It has been the stuff of life for nearly half of the world's population including Bangladesh. No other crops are equal to rice in making it possible for man and animal to provide their food and feed with a minimum labor, land and equipment. Among different rice groups grown in Bangladesh, transplant aman rice is the most important which is cultivated during the rainy season. Since 1985, the area under rice cultivation in Bangladesh has been continuously declined annually due to urbanization and industrialization.

Crop and livestock are interlinked and independent between each other. Livestock sector contributes about 6.5% of gross domestic product (Alam, 1993) and supplies more than 20% agricultural inputs in the form of draft power (Hossain, 1991). There are 58.87 million livestock in Bangladesh. At least estimated present demand of green fodder for the livestock is about 69.22 million tons with per capita consumption of 6 kg per day per animal. But daily supply of the forage is about 0.73 million ton covering 1.15% of the total requirement (Anonymous, 1998). As a result, a large amount of green fodder remains inimitable, which provides great threat to the survival of domestic livestock. To fulfil the requirements of cereal grain for human consumption, farmers use their land for crop production. Due to lack of available fallow land and pasture for green grass, farmers are very much independent on unconventional feed resources to meet the demand for forage. The acute shortage of feeds and fodder has long been identified as a serious constraint to optimum livestock production in Bangladesh (Saadullah, 1995). To meet the challenge of this situation, food and fodder production in the country must be increased. This is possible either by increasing the area under cultivation i.e. horizontal expansion or by increasing yield per unit area per unit time i.e. vertical growth. As the scope for horizontal expansion of food and fodder is limited, in Bangladesh, production has to be increased vertically by adopting various methods of vertical development. Leaf clipping of transplant aman rice at early growing stage can play an important role in this direction. In some deep-water areas of Bangladesh, local deep-water rice (variety-Badal) is grown as fodder (Magor, 1986). Cutting of long duration rice leaves at the vegetative phase is also practiced in India (Copeland, 1972).

Therefore, the study was undertaken with the following objectives:

a. To see the effect of leaf clipping on plant growth and yields of different cultivars of transplant aman rice,
b. To evaluate the feasibility of using green leaves of t. aman rice as green fodder and
c. To identify the proper height of leaf clipping and adopted cultivar for leaf clipping in rice.

## Materials and Methods

The research work was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, during July to December 1999. The experiment consists of two factors, (A) cultivar (I) $C_1$ = latishail (ii) $C_2$ = BR10 (iii) $C_3$ =BR11 and (iv) $C_4$ = BRRI Dhan32 and (B) leaf clipping heights (I) $H_1$ = clipping at 10 cm (ii) $H_2$ = clipping at 15 cm (iii) $H_3$ = clipping at 20 cm and (iv) $H_4$ = control (no clipping). The experiment was laid out in split plot design where the cultivars were assigned in main plots and leaf clipping heights in sub plots. The unit plot size was 4.0X2.5 m$^2$. Thirty-two days old seedlings were transplanted on 25 July 1999 maintaining a spacing of 20X15 cm$^2$. Thirty days after transplanting (DAT) rice leaves were clipped once at different heights i.e., 10, 15 and 20 cm and control (no clipping) which were measured from the ground level of the plant. The green fodder received from the treated plot by clipping were weighed one hour interval upto 6 and 24 h interval upto 72 h to measure the percentage of moisture loss of the green leaves. During the moisture loss determination the day temperature and relative humidity were 32.5, 29.8, 30.4, 31.5°C and 85, 91, 88 and 87% respectively. A portion of green leaves was fed by cow, buffalo, horse, goat and sheep to test whether these animals would like to consume it or not. Cultural operations were done as and when necessary to grow a normal crop. Necessary data were collected and analyzed statistically by using the analysis of variance technique and the significance of mean differences were adjudged by DMRT (Gomez and Gomez, 1984).

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## Results and Discussion

Significant variation was recorded at 30 and 90 days after transplanting (DAT) on plant height due to different cultivar. Plant height of latishail was higher than that of other cultivars during the growing period (Table 1). Plant height of BR10 (52.40 cm) was lower than others but it was statistically similar to BR11 (53.13 cm) and BRRI Dhan32 (54.61 cm) at 30 DAT. At 90 DAT, latishail produced taller plants compared to BR10, BR11 and BRRI Dhan 32, mainly because of its difference in genetic make up. This result is similar with Shamsuddin *et al.* (1988) who reported that plant height differed significantly among nine cultivars. Significant differences in plant height due to different clipping heights were evident from 90 DAT than that of 30 DAT (Table 2). At 90 DAT the maximum plant height (123.63 cm) was obtained in control (no clipping) and the minimum plant (109.90 cm) was found where leaf clipped at 10 cm height. Bardhan and Mondal (1988) also reported similar results and concluded that leaf removal significantly decreased plant height at maturity. Plant height was significantly affected due to interaction between cultivar and leaf clipping height especially at 90 DAT (Table 3). In general latishail produced taller plants in a particular clipping height in comparison to BR10, BR11 and BRRI Dhan32. On the other hand BR10 produced the shortest plants in a particular clipping height. But there was distinct difference on plant height among different cultivars. It was observed that decrease in plant height became more prominent when leaf was clipped at 10 cm height especially in latishail.

There was significant difference in number of leaves hill$^{-1}$ among the cultivars at 90 DAT except 30 DAT (Table 1). At 90 DAT, latishail produced the highest number of leaves hill$^{-1}$ (55.30) while BR10 produced the lowest number of leaves hill$^{-1}$ (31.81), which was statistically identical with BR11 and BRRI Dhan32 (Table 1). It seems that, in case of latishail, number of leaves hill$^{-1}$ increased steadily but incases of other cultivars it was gradually decreased possibly due to the senescence caused by clipping shock. This result is an agreement with that of Anonymous (1986) and reported that some cultivars are more tolerant to leaf clipping than others. Number of leaves hill$^{-1}$ was significantly ($P \leq 0.05$) affected by leaf clipping height at 30 DAT except 90 DAT (Table 2). At 30 DAT the highest and the lowest number of leaves hill$^{-1}$ was produced in control (49.60) and leaf clipping at 20 cm (44.69) plot. Clipping at 20 cm was also statistically similar to clipping at 10 and 15 cm height and these were counted before clipping. At 90 DAT it was found that the highest number of leaves hill$^{-1}$ produced by clipping at 20 cm height and the lowest by clipping at 15 cm height. Number of leaves hill$^{-1}$ was not found to be significantly affected by the interaction between cultivar and leaf clipping height (Table 3).

Significant difference was observed in production of tillers hill$^{-1}$ in respect of different cultivars at 90 DAT (Table 1). Latishail produced higher number of tillers hill$^{-1}$ (10.24) while BR10 produced lower number of tillers hill$^{-1}$ (7.85) at 90 DAT. Mannan (1996) reported that varieties had significant effect on total number of tillers hill$^{-1}$ while conducting a field trial with four

Table 1: Effect of cultivar on different plant characters and yields of transplant aman rice

| | Plant height (cm) | | Leaves hill$^{-1}$ (No.) | | Tillers hill$^{-1}$ (No.) | | | |
|---|---|---|---|---|---|---|---|---|
| Cultivars | 30 DAT* | 90 DAT** | 30DAT* | 90DAT** | 30DAT* | 90DAT** | Green fodder yield (t ha$^{-1}$) | Seed yield (t ha$^{-1}$) |
| Latishail ($C_1$) | 56.27a | 122.57a | 48.95 | 55.30a | 12.10 | 10.24a | 1.98a | 3.05c |
| BR-10 ($C_2$) | 52.40b | 110.69c | 46.21 | 31.81b | 9.86 | 7.85c | 1.95a | 4.01ab |
| BR-11 ($C_3$) | 53.13b | 113.44b | 46.24 | 32.43b | 10.91 | 8.97b | 1.70ab | 4.23a |
| BRRI Dhan32 ($C_4$) | 54.61ab | 114.46b | 44.43 | 33.99b | 9.63 | 8.96b | 1.45b | 3.76b |

Table 2: Effect of leaf clipping heights on different plant characters and yields of transplant aman rice

| | Plant height (cm) | | Leaves hill$^{-1}$ (No.) | | Tillers hill$^{-1}$ (No.) | | | |
|---|---|---|---|---|---|---|---|---|
| Leaf clipping height | 30 DAT* | 90 DAT** | 30DAT* | 90DAT** | 30DAT* | 90DAT** | Green fodder yield (t ha$^{-1}$) | Seed yield (t ha$^{-1}$) |
| Clipping at 10cm ($H_1$) | 54.12 | 109.90d | 45.48b | 37.46 | 10.76a | 8.32d | 2.88a | 3.04c |
| Clipping at 15cm ($H_2$) | 54.66 | 112.52c | 46.06ab | 36.69 | 10.73a | 8.74c | 2.37b | 3.48b |
| Clipping at 20cm ($H_3$) | 53.02 | 115.12b | 44.69b | 40.37 | 9.91b | 9.18b | 1.83c | 4.17a |
| Control (no clipping) ($H_4$) | 54.60 | 123.63a | 49.60a | 39.01 | 11.10a | 9.78a | - | 4.36a |

Table 3: Interaction effect of cultivar and leaf clipping on different plant characters and yields of transplant aman rice

| | Plant height (cm) | | Leaves hill$^{-1}$ (No.) | | Tillers hill$^{-1}$ (No.) | | | |
|---|---|---|---|---|---|---|---|---|
| Treatments | 30 DAT* | 90 DAT** | 30 DAT* | 90 DAT** | 30 DAT* | 90 DAT** | Green fodder yield (t ha$^{-1}$) | Seed yeild (t ha$^{-1}$) |
| $C_1H_1$ | 54.88 | 115.03c-g | 46.40 | 54.38 | 12.08 | 9.93b-d | 2.93ab | 2.22 |
| $C_1H_2$ | 56.69 | 117.58b-e | 49.88 | 54.63 | 12.40 | 10.20a-c | 2.68bc | 2.94 |
| $C_1H_3$ | 56.99 | 120.61b | 47.60 | 58.98 | 11.75 | 10.26ab | 2.30cd | 3.48 |
| $C_1H_4$ | 56.52 | 137.08a | 51.93 | 53.23 | 12.18 | 10.55ab | 0.00 | 3.57 |
| $C_2H_1$ | 53.37 | 104.58j | 48.15 | 29.90 | 10.33 | 7.19h | 3.25a | 3.14 |
| $C_2H_2$ | 52.79 | 107.53ij | 43.20 | 29.50 | 9.40 | 7.71gh | 2.67bc | 3.53 |
| $C_2H_3$ | 49.45 | 110.49g-l | 45.15 | 34.03 | 8.75 | 8.23fg | 1.90de | 4.57 |
| $C_2H_4$ | 53.98 | 120.18b | 48.35 | 33.80 | 10.95 | 8.29fg | 0.00 | 4.81 |
| $C_3H_1$ | 53.64 | 109.43hi | 45.78 | 32.28 | 10.78 | 8.26fg | 2.75a-c | 3.62 |
| $C_3H_2$ | 53.49 | 111.90f-l | 47.03 | 31.43 | 11.70 | 8.79ef | 2.30cd | 3.89 |
| $C_3H_3$ | 52.68 | 113.56d-h | 43.58 | 31.50 | 10.28 | 9.37de | 1.74ef | 4.60 |
| $C_3H_4$ | 52.69 | 118.88bc | 48.58 | 34.53 | 10.90 | 9.45c-e | 0.00 | 4.82 |
| $C_4H_1$ | 54.61 | 110.56g-l | 41.60 | 33.28 | 9.88 | 7.90gh | 2.61bc | 3.18 |
| $C_4H_2$ | 55.67 | 113.07e-h | 44.13 | 31.23 | 9.40 | 8.26fg | 1.81d-f | 3.58 |
| $C_4H_3$ | 52.95 | 115.81b-f | 42.45 | 36.98 | 8.85 | 8.85ef | 1.38f | 4.02 |
| $C_4H_4$ | 55.20 | 118.39b-d | 49.55 | 34.50 | 10.38 | 10.82a | 0.00 | 4.25 |

In a column, figures bearing same or no letter(s) do not differ significantly at 5% level of significance, DAT= Days after transplanting, * and** = Before leaf clipping and after leaf clipping respectively

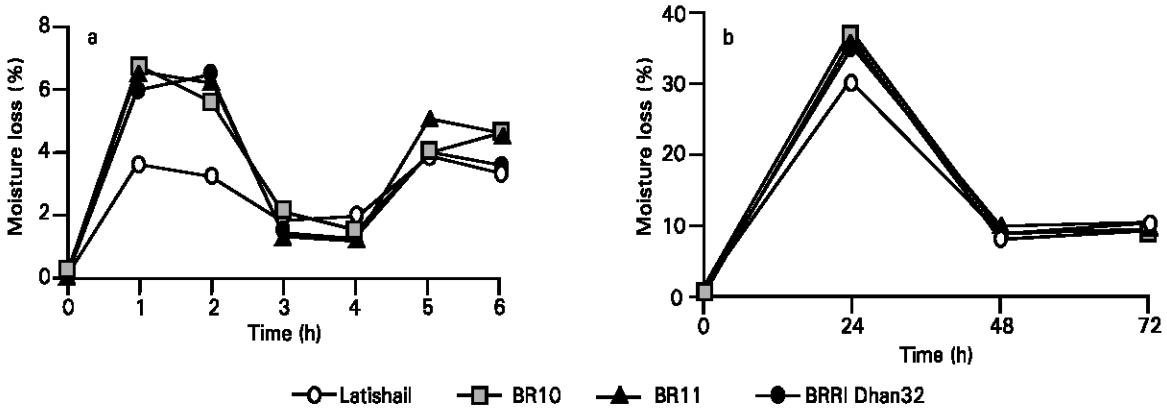


Fig. 1: Percentage of moisture loss by the green fodder of different cultivars of transplant aman rice at different times, a) one hour interval, b) twenty-four hours interval

varieties. The number of tillers hill$^{-1}$ was significantly influenced by different clipping heights at all the growth stage (Table 2). It was observed that plant produced more tillers when clipping was not done (control) during the tillering stage. At 30 DAT, the highest number of tillers hill$^{-1}$ (11.10) was obtained from control, which was identical with clipping at 10 and 15 cm height treatment and the lowest (9.91), was found in clipping at 20 cm height. At 90 DAT, the highest and the lowest number of tillers hill$^{-1}$ were recorded (9.78 and 8.32) from control and leaf clipping at 10 cm height treatment respectively. It was found that number of tillers hill$^{-1}$ declined compared to 30 DAT. This result is similar with the findings of Hachiya (1989) who reported that leaf cutting reduced the number of culms and ears. Number of tillers hill$^{-1}$ was also significantly influenced by the interaction between cultivar and leaf clipping height at 90 DAT except 30 DAT (Table 3). In general all the cultivars produced more tillers hill$^{-1}$ when clipping was not done (control). Tiller production was markedly depressed in all cultivars when clipping was done and it was more prominent in clipping at 10 cm. In a particular clipping height, latishail was superior to other cultivars in respect of tillers hill$^{-1}$. However, the cultivar, which was clipped at 20 cm height produced more or less similar number of tillers hill$^{-1}$ with control.

Green fodder yield was significantly influenced by different cultivars. The result showed that local cultivar latishail produced the highest green fodder yield (1.98 t ha$^{-1}$) which was statistically similar with BR 10 (1.95 t ha$^{-1}$) and BR 11 (1.70 t ha$^{-1}$) (Table 1). This result is also similar to Anonymous (1989) who reported that local aman rice variety gave the highest forage yield at post flood leaf cutting. The lowest green fodder yield was obtained (1.45 t ha$^{-1}$) from BRRI Dhan32. The significant highest (2.88 t ha$^{-1}$) and the lowest (1.83 t ha$^{-1}$) green fodder yield was obtained by clipping at 10 and 20 cm height (Table 2). In general, treatments, which had lower seed yield, produced comparatively higher amount of green fodder and vice-versa. However, when the plants were clipped at 20 cm height produced an average green fodder yield (1.83 t ha$^{-1}$) in addition to higher seed yield, which was statistically similar to the highest seed yield produced from the plants of control. Interaction of cultivar and leaf clipping had significant effect on green fodder yield. The highest (3.25 t ha$^{-1}$) and the lowest (1.38 t ha$^{-1}$) green fodder yield was recorded in BR 10 x clipping at 10 cm ($C_2$ $H_1$) and BRRI Dhan 32 x clipping at 20 cm ($C_4H_3$) respectively. In most cases, weight of green leaves increased gradually with the decrease in clipping heights. The green leaves collected from different treatments were fed to different farm animals, such as cow, buffalo, horse, goat and sheep and all were excepted it as green fodder.

The moisture loss determination data of green fodder of different cultivars were not statistically analyzed. During moisture loss determination, it was found that the rates of moisture loss (%) were different due to different cultivars (Fig. 1a, b). After 0, 1, 2, 3, 4, 5 and 6 h from the start, it was found that the moisture loss (%) were in latishail 0, 3.65, 3.25, 1.97, 2.04, 4.01 and 3.54, BR10 0, 6.70, 5.62, 2.21, 1.61, 4.14 and 4.73, BR11 0, 6.56, 6.29, 1.38, 1.38, 5.20 and 4.71 and BRRI Dhan32 0, 5.98, 6.49, 1.54, 1.36 4.14 and 3.75 respectively. On the other hand, after 0, 24, 48 and 72 h from the start, the moisture loss (%) were latishail 0, 30.19, 10.07 and 10.64, BR10 0, 37.10, 9.23 and 9.59, BR11 0, 36.10, 8.82, 10.66 and BRRI Dhan32 0, 35.30, 8.30 and 9.84 respectively.

First six hours and upto 24 h latishail loosed the lowest percentage of moisture and BR10 loosed more or less the highest percentage of moisture. But after 48 and 72 h the moisture loss tendency of those cultivars were changed and it may be due to change of the day temperature and relative humidity. However, the green fodder receiving from latishail relatively contains long time freshness. Seed yield significantly differed among the cultivars of transplant aman rice (Table 1). BR11 produced the highest seed yield (4.23 t ha$^{-1}$) which was statistically identical with BR10 (4.01 t ha$^{-1}$). Lower seed yield was recorded in latishail (3.05 t ha$^{-1}$). Similar result was found by Ali and Murship (1993) and Roman (1997) who reported that the local variety statistically out yielded than the modern cultivar BR11. Significantly higher and statistically identical seed yields (4.36 and 4.17 t ha$^{-1}$) were obtained from control and clipping at 20 cm height respectively (Table 2) and it showed that rice plant recovered itself after leaf clipping. Satoto (1989) also found that leaf clipping on rice MR 365A had no significant effect in respect of seed yield. The lowest seed yield (3.04 t ha$^{-1}$) was obtained from clipping at 10 cm height. Interaction of cultivar and leaf clipping had no significant effect on seed yield. However, higher seed yields were observed in all cultivars with control (no clipping) than those cultivars with leaf clipping. It was also observed that seed yield decreased when clipping height was decreased. During the rainy season, when most of the area in Bangladesh is under water and when fodder crop availability is minimum, then this can meet the animal feed requirement to a considerable extent. From the scope and limitation of the present study, it may be concluded that it is possible to get rice seed and green fodder from the same transplant aman rice like latishail and BR11 and the leaf clipping height may be upto 20 cm at 30 DAT.

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