



## **Effect of Lopping on Lodging, Productivity and Labor Utilization for Rice Cultivation at Transplanting Aman Season**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

To study the effect of lopping on lodging, productivity and labor utilization for rice cultivation an experiment was conducted at BRRI Farm, Gazipur during Transplanting Aman in a randomized complete block design (Factorial) with three replications. The experimental treatments were: three lopping viz. i) Control i.e., no lopping ii) lopping at 30 DAT and iii) lopping at 45 DAT; and two cultivars viz. i) BR 22 and ii) BRRI dhan32. Interaction effect of lopping and variety was not significant. The tallest plant (123 cm) was found in 'no lopping' treatment followed by lopping at 30 and 45 DAT. A similar trend was observed in lodging (%) and labor requirement for harvesting of rice. Lopping at 45 DAT produced the highest number of filled grain panicle<sup>-1</sup> (117), grain yield (5.9tha<sup>-1</sup>) and straw yield (6.5tha<sup>-1</sup>) followed by lopping at 30 DAT and no lopping (control). However, there was no significant effect of lopping on labor requirements for threshing of rice. Therefore, effect of lopping on the yield and yield contributing characters of rice showed that lopping had positive effect on yield and decreasing lodging tendency of the studied variety. It was found that lopping at 45 DAT and 30 DAT could increase the rice yield. BR22 and BRRI dhan32 had statistically similar effect on lodging tendency.

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## 1. INTRODUCTION

Rice (*Oryza sativa*) belongs to the family Poaceae. In Asian countries, rice is a staple food for at least 62.8% of total planet inhabitants and it contributes on an average 20% of apparent calorie intake of the world population and 30% of the population [1]. The overall agricultural development in Bangladesh conceals considerable regional differences because of farming practices, techniques, availability of irrigation facilities, attitude of the farmer etc. in different parts of the country. Regional variations in agricultural development show that there is scope to boost up the pace of agricultural development and thereby that of economic development in the country with area specific agricultural development programmes and policies [2]. The poor economy of the country cannot afford to contend with low rate of crop yields in view of heavy pressure of population on agriculture.

Rice straw is the staple feed for the livestock, but this straw is not sufficient for livestock population during Kharif season when the entire fields are occupied by wetland rice. Moreover, there is a severe crisis of green fodder during this lean period. The only livestock feed supply is rice straw which are nutritionally poor and also less in quantity because of limited land holding. On the other hand, heavy wind speed and hailstorm is common during October to November the reproductive to ripening phase of most T. Aman cultivars in Bangladesh.

Detopping or lopping is one of the suitable management options for reducing plant height. One the other hand it is one of the best options to feed cattle during rainy days. In some deep-water areas of East Pakistan, Badal a traditional deep-water rice variety is grown as a fodder [3]. Cutting long duration rice leaves at the vegetative stage is also practiced in India [4] and is now more frequently done in Thailand [5]. Detopping really has no effect on the production of grains it may become one of the most economical ways of increasing the yield, with the additional advantages of controlling lodging in case of excessive vegetative growth and will provide the farmers with green feeding materials for their work animals, without sacrificing the grain yield.

In general, long duration rice varieties have higher plant height (125 to 140 cm) than short

duration varieties [6] and these cultivars has higher tendency to lodge. Suitable management practices are essential to ensure expected yield of these variety. Lopping at proper time can ensure good yield and can be able to reduced labor cost during harvesting. With the view, the objective of the study is to find out the effect of lopping on yield, yield component of rice and labor utilization.

## 2. MATERIALS AND METHODS

### 2.1 Experimental Area

This experiment was conducted at the West Byde of the Bangladesh Rice Research Institute (BRRI) farm, Gazipur during T. Aman season. The study location is 23°74'N latitude and 88°35' longitude with an elevation of 8.2 meter from sea level. Sub-tropical monsoon climate condition prevails in the study area. Seventy percent of the total rainfall is received during July to September, with average annual rainfall of 2148 mm. April is the hottest month, with average minimum and maximum temperatures of 23.6°C and 33.7°C, respectively [7].

The soils of the study site were characterized as silt clay loam with moderate drainage.

### 2.2 Treatments

The experiment was laid out in a Randomized Complete Block design (Factorial) with three replications. The unit plot size was 4m×2.5m and. Thirty days old rice seedlings were transplanted with the planting spacing of 20 cm×20 cm. BRRI developed two modern rice varieties, BR22 and BRRI dhan32 were transplanted with three treatments. The treatments were 3 lopping viz. i) Control (no lopping) ii) lopping at 30 days after transplanting (DAT) and iii) lopping at 45 DAT.

BRRI recommended fertilizers such as Urea, TSP, MP, Gypsum and Zinc were applied at the rate of 127-52-82-60-0 kg $ha^{-1}$ . TSP, MP, Gypsum and Zinc were applied at final land preparation. Three equal splits of urea were applied at 15, 45 and 55 days after transplanting (DAT). All other cultural operations like weeding, insect-pest and disease management was done as and when necessary.

### 2.3 Variables Evaluated and Data Analysis

The morphological and yield attributes of this experiment are plant height, number of tillers/hill, number of fertile tillers/hill, number of infertile tillers/hill, length of panicle, grain yield, straw yield. Data of plant height and number of tillers/hill were recorded weekly interval and then averaged up to harvest. Data were counted from 10 selected samples in the field. Yields and yield components data were collected at maturity of the crop. Time requirement ( $\text{man-dayha}^{-1}$ ) for harvesting and threshing were recorded during the period of operation where, eight hours work for laborers was considered as one man-day. Collected data were analyzed in a statistical tool cropstat and the mean differences were adjusted by LSD method.

## 3. RESULTS AND DISCUSSION

### 3.1 Interaction Effect of Lopping and Variety

In this experiment, interaction effect of lopping and variety was not significant. So, only main effects were presented and discussed here.

### 3.2 Effect of Lopping

The plant height was significantly affected by lopping (Table 1). The tallest plant height (123.6 cm) was observed in "no lopping" treatment followed by lopping at 30 DAT (117.4 cm) and 45 DAT (104.2 cm). This result is similar to Usman et al. [8] who have found that late detopping reduced plant height than early detopping. A similar trend of was observed in lodging at maturity. Among the treatment no lopping showed the highest (30.5%) lodging at maturity followed by 19.8% lodging at looped at 30 DAT. The lowest 10.3% plant lodged when the plant lopped at 45 DAT. There is a close relationship between labor requirement in harvesting and percent lodging. Labor requirement for harvesting was higher in no lopping plot than lopped plot. The highest 23.5  $\text{man-day ha}^{-1}$  labor was required for no lopping treatment whereas 20.3  $\text{man-day ha}^{-1}$  and 18.5  $\text{man-day ha}^{-1}$  labor was applied in treatment lopped at 30 DAT and lopped at 45 DAT respectively. However, no significant difference was observed in labor requirement for threshing of harvested rice. It was clear that the effect of the loop on the yield

and on the parameters that contribute to the presented results, showed that they affected the grain by panicle and grain not filled by panicle, as well as yield of grains and straw were also affected, and the inverse was observed in grains not filled by panicle. The highest straw yield at 45 DAT was significantly affected and this result implies that the panicle length decreased.

Effect of lopping on yield and yield contributing parameters were analyzed and presented on Table 2. Result showed that the panicle length, effective tiller  $\text{hill}^{-1}$  and non bearing tiller per hill were not significantly influenced by lopping but the grain per panicle, unfilled grain per panicle, grain and straw yield were significantly affected by lopping action. It was found that lopping at 45 DAT produced the highest number of filled grain panicle $^{-1}$  followed by lopping at 30 DAT and control. A reverse trend was observed in unfilled grain per panicle. Lopping at 45 DAT produced the highest grain yield followed by no lopping and lopping at 30 DAT. There was no significant difference between lopping at 30 DAT and no lopping. The highest straw yield was observed in lopping at 45 DAT followed by lopping at 30 DAT and no lopping treatment. This result is not identical to Bardhan and Mondol [9] who has observed that panicle length decreased due to detopping.

### 3.3 Effect of Variety

Plant height of BR22 (117.7 cm) was significantly higher than BRR1 dhan32 (112.8 cm) but intensity of lodging had no significant effect (Table 3). Both the varieties have similar lodging at maturity. But BR22 required more labor (21.3  $\text{man-day ha}^{-1}$ ) for harvesting than BRR1 dhan32 (20.3  $\text{man-day ha}^{-1}$ ). This is because of higher plant height of BR11. The labor requirement for threshing was not significantly influenced by variety.

Table 4 showed effect of varieties on yield and yield contributing parameters. Panicle length, effective tiller  $\text{hill}^{-1}$ , non-effective tiller  $\text{hill}^{-1}$ , unfilled grain panicle $^{-1}$  and grain yield were not significantly affected by variety. BRR1 dhan 32 produced higher number of filled grain panicle $^{-1}$  than BR22. Similar grain yield BR22 produced higher straw yield (Table 4). The highest value of sterility in control may be due to photo-sensitive and thermo-sensitive genetic male sterility, which is restored when the environmental conditions change as reported by Virmani [10].

**Table 1. Effect of lopping on plant height, lodging and labor requirements for harvesting and threshing during T. Aman, 2001 at BRRi farm, Gazipur**

Treatments	Plant height (cm)	Lodging at maturity (%)	Laborer for harvesting (man-day ha <sup>-1</sup> )	Laborer for threshing (man-day ha <sup>-1</sup> )
No lopping	123.6a	30.5a	23.5a	12.4
Lopped at 30 DAT	117.9b	19.8b	20.3b	11.5
Lopped at 45 DAT	104.2c	10.3c	18.5c	10.4
lsd (0.05)	1.5	0.69	0.28	ns

*Number followed by different letters in the same column differs significantly. ns=not significant*

**Table 2. Effect of lopping on yield and yield components during T. Aman, 2001 at BRRi, Gazipur**

Treatments	Panicle length (cm)	Effective tiller hill <sup>-1</sup>	Non bearing tiller hill <sup>-1</sup>	Filled grain panicle <sup>-1</sup>	Unfilled grain panicle <sup>-1</sup>	Grain yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )
No lopping	24.3	12.0	3.3	95c	51a	5.6b	6.2b
Lop. at 30 DAT	25.7	11.0	3.0	104b	43b	5.4b	6.5ab
Lop. at 45 DAT	26.6	11.0	2.3	117a	40b	5.9a	6.9a
lsd (0.05)	ns	ns	ns	3.5	4.9	0.22	0.45

*ns=not significant; different letters in the same column differs significantly*

**Table 3. Effect of variety on plant height, lodging and labor requirements for harvesting and threshing during T. Aman, 2001 at BRRi farm, Gazipur**

Variety	Plant height (cm)	Lodging at maturity (%)	Laborer for harvesting (man-day ha <sup>-1</sup> )	Laborer for threshing (man-day ha <sup>-1</sup> )
BR 22	117.7a	24.7	21.3a	11.7
BRRi dhan32	112.8b	25.7	20.3b	11.2
lsd (0.05)	3.9	ns	0.72	ns

*ns=not significant, different letters in the same column differs significantly.*

**Table 4. Effect of variety on yield components, yields and others parameters**

Variety	Panicle length (cm)	Effective tiller hill <sup>-1</sup>	Non-effective tiller hill <sup>-1</sup>	Filled grain panicle <sup>-1</sup>	Unfilled grain panicle <sup>-1</sup>	Grain yield (tha <sup>-1</sup> )	Straw yield (tha <sup>-1</sup> )
BR 22	25.3	11.0	2.9	103.6b	43.7	5.7	6.7a
BRRi dhan32	25.8	11.0	2.8	107.7a	45.0	5.6	6.3b
Lsd (0.05)	ns	ns	ns	2.8	ns	ns	0.37

*ns=not significant, different letters in the same column differs significantly*

#### 4. CONCLUSION

Effect of lopping and variety on the yield and yield contributing characters of rice showed that lopping had positive effect on yield and decreasing lodging tendency of the studied variety. It was found that lopping at 45 DAT and 30 DAT could increase the rice yield. BR22 and BRRi dhan32 had statistically similar effect on lodging tendency. Lopping has a great advantage on reduction of labor requirement in harvesting as well as it saves cost of production.

Lopping has shown the advantage in reducing the need for labor in the harvest, this implies savings in cost of production, an increasingly sensitive factor in food production. But optimum time of lopping may varied on cultivar and management practices.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Begum S, Rahman MH, Nasif SO, Ahamed KU. Effect of sowing dates on some morpho-physiological traits of an Exotic (China) hybrid rice variety in Bangladesh. *J. Agric. Ecol. Res. Intl.* 2018;15(2):1-10. DOI: 10.9734/JAERI/2018/43008
2. Singh V. *Regional Disparities in Agricultural Development*, Deep and Deep Publications, New Delhi, India. 1990;13.
3. Magor S. Annual Reports for 1985-86. Deep Water Paddy Res. Station, Habiganj, Bangladesh. 1986;1-4.
4. Copeland SM. Cultural trials and practices of rice in India. *Central Rice Res. Inst. Cuttack.* 1972;23:21-22.
5. Kupkanchanakul T, Kupkanchanakul K, Roontun S, Vergara BS. Herbage and grain yield of deepwater rice in the field. *Int. Rice Res. Newsl.* 1991;16:10-11.
6. Anonymous. *Adhunik Dhaner Chash*. 21<sup>st</sup> Edition. Bangladesh Rice Research Institute, Gazipur. 2018;99.
7. Ahmed F, Choudhury AK, Akhter S, Aziz MA, Biswas JC, Maniruzzaman M, Miah MMU, Rahman MM, Jahan MAHS, Ahmed IM, Sen R, Ishtiaque S, Islam AFMT, Haque MM, Hossain MB, Kalra N, Rahman MH. Calibration and validation of decision support system for agro-technology transfer model for simulating growth and yield of maize in Bangladesh. *American J. Plant Sci.* 2017;8:1632-1645. Available: <https://doi.org/10.4236/ajps.2017.87113>
8. Usman K, Khan EA, Khan Q, Wakil A, Khan MU. Effect of Detopping on Dorage and grain yield of rice under agro-climatic conditions of D. I. Khan. *Sarhad J. Agric.* 2007;23(1):56-60.
9. Bardhan SK, Mondol BK. Effect of leaf cutting for herbage in deep water rice. *Int. Rice Res. Newsl.* 1988;12:16-19.
10. Virmani SS. *Heterosis and hybrid rice breeding*. Monograph on theoretical and applied genetics. Springer-Verlag, Berlin Heidelberg, New York. 1994;22.

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