Effect of Seedling Hill$^{-1}$ and Culm Cutting Height on Rice Green Fodder, Hay and Seed Yield of Transplant Aman Rice

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Abstract: A field experiment was conducted to investigate the effect of four different number of seedling hill$^{-1}$ viz., 2, 3, 4 and 5 and five different culm cutting height viz., 5, 10, 15, 20 cm and no cutting (control) on rice green fodder, hay and seed yield of transplant aman rice cv. Binadhan 4. Results revealed that the green fodder yield increased with the decreasing cutting height. The highest (4.66 t ha$^{-1}$) and the lowest (2.75 t ha$^{-1}$) green fodder yields were obtained from cutting at 5 and 20 cm, respectively. Similarly, the highest green fodder yields (3.13 t ha$^{-1}$) were found by 5 and 4 seedling hill$^{-1}$ treatments. The highest hay yield was obtained from 20 cm cutting height and 5 seedling hill$^{-1}$. Plant height was positively related to cutting height, the highest (141.38 cm) and the lowest (117.67 cm) plant height at harvest were due to control and cutting at 5 cm treatments, respectively. Seed yield decreased with the decreasing cutting height. The highest and the lowest seed yields were obtained from control and cutting at 5 cm, respectively. The highest seed yield was found in 3 seedling hill$^{-1}$.

Key words: Seedling hill$^{-1}$, culm cutting height, rice green fodder, hay and seed yield

Introduction
Bangladesh is primarily a rice producing country. Agriculture in Bangladesh is characterized by intensive crop production with the rice based cropping system. Bangladesh earns about 32% of her gross domestic product (GDP) from agriculture (Anonymous, 1998). Among the various factors that influence rice production, number of seedling hill$^{-1}$ is possibly an important one (Chowdhury et al., 1993). Optimum number of seedling hill$^{-1}$ may enable the rice plant to grow properly both in its aerial and underground parts by utilizing maximum radiant energy, nutrients, space and water and also could result in enhancing seedling cost of farmer. The excess or least number of seedling hill$^{-1}$ may badly affect the normal physiological activities of the rice plant. Excess number of seedling hill$^{-1}$ may produce higher number of tillers hill$^{-1}$ resulting mutual shading and thus favour the production of more straw instead of grain. While the least number of seedling hill$^{-1}$ may cause insufficient tiller growth thus keeping air space and nutrients unutilized in soils and the end, total panicles hill$^{-1}$ area will be reduced resulting in poor yield.

Livestock plays an important role in agriculture of Bangladesh. Cattles are the main source of draught power for cultivation. The biggest constraints of livestock production in Bangladesh is the acute shortage of quality feeds and fodder, both in quality and quantity. Low intake of feed has already been considered as one of the important reasons for reducing draught power and lowering yield of dairy products (Anonymous, 1997). 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. Severe crisis of green forage occurs during August-October, when entire fields are occupied by transplant aman rice. So, this study was conducted to overcome the scarcity, food-cum forage crop like rice seems to be one of the most feasible and economically viable practice to serve the needs of human food, cash income and animal feed, particularly for those who have limited resources.

Materials and Methods
The experiment involving four seedlings hill$^{-1}$ with five culm cutting treatments were: $S_1$ = 2 seedling hill$^{-1}$, $S_2$ = 3 seedling hill$^{-1}$, $S_3$ = 4 seedling hill$^{-1}$, $S_4$ = 5 seedling hill$^{-1}$ and $S_5$ = no cutting (control). $H_1$ = cutting at 5 cm, $H_2$ = cutting at 10 cm, $H_3$ = cutting at 15 cm and $H_4$ = cutting at 20 cm of Binadhan 4 was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during July to December 2000. The experimental area belongs to the Sonatola soil series under Old Brahmaputra Floodplain (AEZ9) (UNDP and FAO, 1988). The experiment was laid out in a split-plot design. The size of each unit plot was 10 m$^2$ (4.0 x 2.5 m). Thirty days old seedling were transplanted on 10 July 2000, maintaining the spacing of 20 x 15 cm. Cutting treatment was done 26 days after transplanting (DAT) on 5 August, 2000. In the cutting plots, rice culm were removed as per experimental specification which were measured from the ground level. The experimental area was fertilized with 78, 62, 39. 4.5 and 1.5 kg ha$^{-1}$ of N, P, K, Ca, S and Zn in the form of urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate, respectively (Unnati, Kriso Projgi Porichit). Other cultural practices were followed as and when necessary. Green fodder, hay, seed yield and yield components were measured from randomly selected 10 hills of each plot. Analysis of variance was done with the help of computer package MSTAT. The mean differences among treatments were adjudged as per tested with Duncan's multiple range test (Gomez and Gomez, 1984).

Results and Discussion
Number of seedling hill$^{-1}$ significantly influenced by green fodder yield, plant height, number of effective and non-effective tillers hill$^{-1}$, number of sterile spikelets panicle$^{-1}$, seed yield and harvest index. Two seedling hill$^{-1}$ produced significantly the highest plant height (129.43 cm) (Table 1). Shah et al. (1991) reported that plant height decreased with increasing seedlings hill$^{-1}$1. It may be due to the sharing of nutrients among the seedlings. Number of effective tillers hill$^{-1}$ (7.78), this is mainly due to sufficient availability of nutrients, light and air. As a result there was less competition for these vital resources for proper growth and nourishment of rice plants. Wan and Yang (1991) agreement this result. Number of sterile spikelets panicle$^{-1}$ (9.8) and harvest index (33.5%) of. Except the number of sterile spikelets panicle$^{-1}$ those were statistically at par with 3 seedling hill$^{-1}$. All these above characters 5 seedling hill$^{-1}$ produced the lowest value except number of sterile spikelets panicle$^{-1}$. Four seedling hill$^{-1}$ exhibited identical value with 5 seedling hill$^{-1}$ excluding number of sterile spikelets panicle$^{-1}$. Only green fodder production and number of non-effective tillers hill$^{-1}$ 5 seedling

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<table>
<thead>
<tr>
<th>Treatments</th>
<th>1</th>
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<tr>
<td>Cutting height</td>
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<td>H₀ (control)</td>
<td>2.94a</td>
<td>0.68</td>
<td>6.70</td>
<td>6.28</td>
<td>129.43a</td>
<td>7.78a</td>
<td>2.21b</td>
<td>22.78</td>
<td>67.47</td>
<td>24.94a</td>
<td>26.47</td>
<td>4.39a</td>
<td>43.39a</td>
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<td>H₁</td>
<td>2.92b</td>
<td>0.60</td>
<td>6.80</td>
<td>6.40</td>
<td>129.29ab</td>
<td>7.91a</td>
<td>2.07a</td>
<td>22.93</td>
<td>67.60</td>
<td>23.96b</td>
<td>26.40</td>
<td>4.42a</td>
<td>43.32a</td>
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<td>2.90a</td>
<td>0.62</td>
<td>6.87</td>
<td>6.49</td>
<td>129.57bc</td>
<td>7.47b</td>
<td>2.32a</td>
<td>22.59</td>
<td>66.82</td>
<td>23.12c</td>
<td>26.49</td>
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<td>H₃</td>
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<td>6.57</td>
<td>125.13b</td>
<td>7.41b</td>
<td>3.72a</td>
<td>22.67</td>
<td>69.98</td>
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<td>26.49</td>
<td>4.06b</td>
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</table>

1 = Greed fodder yield (t ha⁻¹)
2 = Dry fodder yield (t ha⁻¹)
3 = Hay yield (t ha⁻¹)
4 = Cumulative hay yield (t ha⁻¹)
6 = Plant height (cm)
7 = Number of effective tillers hill⁻¹
8 = Number of grains panicle⁻¹
9 = Number of sterile spikelets panicle⁻¹
11 = 1000-seed weight (g)
12 = Grain yield (t ha⁻¹)
13 = Harvest index (%)

In a column, means followed by the same or no letter(s) are not significantly different at 5% level by DMRT.

Hill⁻¹ exhibited the highest value 3.03 t ha⁻¹ and 3.72, respectively. In these characters 4 seeding hill⁻¹ produced similar results with 5 seeding hill⁻¹. Incase of green fodder 2 seeding hill⁻¹ yielded the lowest (2.84 t ha⁻¹) and 3 seeding hill⁻¹ produced moderate (2.92 t ha⁻¹). Number of non-effective tillers hill⁻¹ 3 seeding hill⁻¹ gave the lowest value which was similar to 2 seeding hill⁻¹. Dry fodder yield, hay yield, cumulative hay yield, panicle length and grains panicle⁻¹ did not differ significantly due to seeding hill⁻¹ treatment. Except 1000-seed weight and harvest index cutting height markedly differ all the characters. Cutting at 5 cm produced the highest green fodder (4.55 t ha⁻¹) and the lowest in 20 cm. With decreasing cutting height the green fodder yield was increased. In general, treatments which gave lower seed yield produced comparatively higher amount of green fodder yield. However, when the plants were cut at 20 cm height, it produced an average green fodder yield of 2.75 t ha⁻¹ in addition to higher seed yield (4.62 t ha⁻¹) which was statistically similar to the highest seed yield (4.67 t ha⁻¹) as compared with control treatment. Therefore, cutting at 20 cm appeared to be beneficial. Ahmed et al. (2001) reported similar result. Dry fodder yield produced the highest when cutting operation was done at 5 cm and the lowest from 20 cm. Except cumulative hay yield, plant height, both number of effective and non-effective tillers hill⁻¹, panicle length, number of grains panicle⁻¹, number of sterile spikelets panicle⁻¹, seed and hay yield produced the highest value incase of control treatment (no cutting) and gave the lowest value when plants were cut at 5 cm above ground level. The highest cumulative hay yield (7.35 t ha⁻¹) was produced from 20 cm cutting treatment and the lowest from 5 cm cutting treatment. The weight of 1000-seed and harvest index did not differ significantly due to cutting treatments. Since 1000-seed weight is a genetic character of a variety, it may not differ due to cutting treatments. Kupkanchanakul et al. (1990) noted that effect of cutting frequency on rice herbage did not affect 1000-seed weight. There was no significant variation between the interaction of the seedlings hill⁻¹ and cutting height.

Finally, it may be concluded that during the aman season when entire fields of Bangladesh are covered by transplant aman rice and severe crisis of green fodder and hay occurs for our cattle, it is possible to get moderate green fodder yield and maximum seed yield of transplant aman rice (cv. Binadhan 4) could be obtained from 3 seeding hill⁻¹ with cutting at a height of 20 cm at vegetative growth stage.

References