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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 (4.55 t ha^{-1}) and the lowest (2.75 t ha^{-1}) green fodder yields were obtained from cutting at 5 and 20 cm, respectively. Identically the highest green fodder yields (3.03 and 2.99 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 reduce seedling cost of farmers. 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 airspace and nutrients unutilized in soils and at the end, total panicles unit^{-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 has 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 H_0 = 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 × 2.5 m^2). Thirty days old seedling were transplanted on 10 July 2000, maintaining the spacing of 20 × 15 cm^2. 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_2O_5, K_2O, S and Zn in the form of urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate, respectively (Unnata Krishi Projugti Porichiti, 1998). 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}. 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. Wen and Yang (1991) agreement this result. Number of sterile spikelets panicle (24.94), seed yield (4.36 t ha^{-1}) and harvest index (43.38%). 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 1: Effect of seedling hill^{-1} and cutting height on growth, yield and yield contributing characters of transplant aman rice

Treatments	1	2	3	4	5	6	7	8	9	10	11	12	13
Seedling hill^{-1}													
S_1	2.84c	0.58	5.70	6.28	129.43a	7.78a	2.21b	22.76	67.47	24.94a	25.47	4.36a	43.38a
S_2	2.92b	0.60	5.80	6.40	128.98ab	7.91a	2.07b	22.63	67.50	23.38b	25.48	4.42a	43.32a
S_3	2.99a	0.62	5.87	6.49	125.67bc	7.47b	3.42a	22.69	65.98	23.12c	25.48	4.06b	40.89b
S_4	3.03a	0.62	5.95	6.57	125.13c	7.41b	3.72a	22.67	65.98	22.19b	25.49	4.05b	40.45b
Cutting height													
H_0 (control)	-	-	6.54a	6.54b	141.38a	9.06a	3.58a	23.47a	69.81a	26.04a	25.53	4.67a	41.62
H_1	4.55a	0.90a	4.83c	5.73c	117.67c	5.87d	2.00b	21.71d	62.12b	21.03b	25.42	3.68d	42.51
H_2	3.95b	0.80b	5.36bc	6.16bc	122.42b	6.46c	2.06b	22.42c	65.10ab	22.85b	25.45	3.94c	42.32
H_3	3.48c	0.71c	5.94ab	6.65b	125.47c	8.15b	3.25a	22.69bc	67.27a	23.68ab	25.48	4.31b	42.00
H_4	2.75d	0.63d	6.47a	7.35a	129.58b	8.68a	3.39a	23.15ab	69.37a	23.44ab	25.52	4.62a	41.61

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})
5 = Plant height (cm), 6 = Number of effective tillers hill^{-1}, 7 = Number of non-effective tillers hill^{-1},
8 = Panicle length (cm), 9 = Number of grains panicle^{-1}, 10 = Number of sterile spkilets 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 seedling hill^{-1} produced similar results with 5 seedling hill^{-1}. Incase of green fodder 2 seedling hill^{-1} yielded the lowest (2.84 t ha^{-1}) and 3 seedling hill^{-1} produced moderate (2.92 t ha^{-1}). Number of non-effective tillers hill^{-1} 3 seedling hill^{-1} gave the lowest value which was similar to 2 seedling hill^{-1}. Dry fodder yield, hay yield, cumulative hay yield, panicle length and grains panicle^{-1} did not differ significantly due to seedling 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 is 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 seedling hill^{-1} with cutting at a height of 20 cm at vegetative growth stage.

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