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Effects of Different Doses of Nitrogen Fertilizer on Yield and Chemical Composition of Zamboo Grass

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Abstract: The experiment was carried out at the Department of Animal Nutrition, Bangladesh Agricultural University, Mymensingh, to study the effects of different doses of nitrogen (N) fertilizer on yields and chemical composition of Zamboo grass. The fodder was cultivated at 4 levels of N fertilizer viz., 0, 50, 100 and 150 kg urea ha^{-1} in a completely randomized design having four replications in each treatment. The unit plot size of each replicate was 4×4 m. The fodder was harvested at the pre flowering stage (68 days after sowing) for first cutting and again 40 days after first cutting. The proximate components of the fodder for each plot were determined at the laboratory, Department of Animal Nutrition. The results of the study showed that the total yields (t ha^{-1}) of Zamboo grass on fresh basis were 11.08, 15.63, 22.35 and 26.72 in the first cuttings and 7.94, 12.24, 16.65 and 22.41 in the second cutting using 0, 50, 100 and 150 kg urea ha^{-1}, respectively. The total dry matter (DM) yield of fodder for first cutting at the treatment levels of 0, 50, 100 and 150 kg urea ha^{-1} were found to be 1.85, 2.75, 3.66 and 4.60 t ha^{-1} and those in second cutting were 0.67, 2.13, 3.08 and 3.97 t ha^{-1}, respectively. Total yields of fodder green as well as DM basis in both cutting progressively and significantly increased with the increasing levels of N fertilizer doses. Similarly crude protein (CP), crude fiber (CF) and ether extract (EE) yields (t ha^{-1}) were increased with increasing fertilizer doses. The green fodder as well as DM yields and percent of different proximate components of each treatment were higher in the first cutting than that of the second cutting except CF. The DM percent of the fodder was almost similar for different fertilizer treatments in both cutting. Among the various proximate components, CP, CF and EE percent increased by increasing the N fertilizer doses while ash percentage decreased.

Key words: Nitrogen fertilizer, yield, chemical composition, grass

INTRODUCTION

Shortage of animal feed is the major constraint of animal production in Bangladesh and is likely, in turn, to increase the predisposition of animal diseases and mortality. Due to intensification of crop production, hardly any land is available for animal feed production. According to a report the deficit of total feed dry matter (DM) in the country was 25.6 million tons and that of crude protein (CP) was 3.10 million tons[1]. More than 90% of the feeds consumed by the ruminants in our country is roughage. Tareque[2] reported that out of total 29.1 million tons of roughage available for ruminants, rice straw contributes around 23.27 million tons (81%) and green fodders only 1.6 million tons. The farmers of Bangladesh cannot afford to spare lands for fodder production for feeding livestock but sufficient quantity of green grass is necessary in the ration for proper growth and reproduction of animals.

Sufficient information was not available on yield and chemical composition of Zamboo grass as affected by different doses of nitrogen (N) fertilizer under Bangladesh condition. The plant yield and chemical composition of fodder varies due to many factors such as the soil quality, plant density, fertilizer doses, growing seasons and stage of maturity etc.[3]. Among the various factors, N application is important which directly contributes to the quantity and quality of fodder production. The N levels applied to grasses varying widely under different soil and climatic conditions, but information on the optimum N level for Zamboo grass is very meagre and therefore, needs careful consideration for its application. Keeping

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this in view, the present experiment was designed to study the effects of N fertilizer doses on yields and chemical composition of Zamboo grass.

MATERIALS AND METHODS

Experimental site: The experiment was conducted at the Animal Nutrition field laboratory of the Department of Animal Nutrition, Bangladesh Agricultural University, Mymensingh during the period from May 1999 to September 1999.

Experimental design and treatments: The experiment was conducted in completely randomized design (CRD) comprised 4 nitrogen (N) levels viz., 0, 50, 100 and 150 kg urea ha^{-1}. Each treatment was replicated four times. Size of each experimental plot was 4×4 m.

Fertilizer application: Phosphorus fertilizer (P_2O_5) in form of triple super phosphate (TSP) and murate of potash (MP) was applied at a rate of 50 kg ha^{-1} during land preparation. Fifty percent of the required N fertilizer of different doses was applied before sowing in the form of urea and remaining fifty percent was applied after 5 weeks of sowing as top dressing. All the plots received a basal dose of 20 q ha^{-1} of cowdung.

Sowing of seeds: The seeds were sown in rows by line sowing method maintaining the distance of 25cm and 5cm for row to row and plant to plant, respectively. The seed rate was 50 kg ha^{-1}. Weeding was done once during the experimental period. No irrigation and insecticides were used.

Harvesting of the fodder: Zamboo grass in each plot was harvested at the pre flowering stage (68 days after sowing) and green fodder yield was recorded. Each plot was kept for further growing of fodder. After 45 days of first cutting, the fodder was harvested again and fodder yield was recorded at fresh basis.

Collection of samples: During first and second harvesting, the representative samples of Zamboo grass were collected at random from each treatment plot. After collection they were tagged separately and kept for further processing. At the same time freshly collected five representative plants from each plot was chopped into small pieces and kept for determining dry matter (DM) content of the fodder.

Chemical analysis: Samples of the whole plant of Zamboo grass for different treatments were subjected to chemical analysis for the determination of crude protein (CP), crude fiber (CF), ether extract (EE) and total ash contents following the methods of AOAC[4].

Statistical analysis: Data were analyzed using MSTAT-C statistical program for a completely randomized design and differences among the treatment means were determined by the least significant difference method[5].

RESULTS AND DISCUSSION

Green grass yield: Total green grass yields were 11.08, 15.63, 22.35 and 26.72 t ha^{-1} for first cutting and 3.94, 12.24, 16.65 and 22.41 t ha^{-1} for second cutting using N fertilizer levels of 0, 50, 100 and 150 kg urea ha^{-1}, respectively (Table 1 and 2). The increasing levels of N fertilizer in both first and second cutting significantly influenced total yield. In first cutting total yields of green grass was maximum (26.72 t ha^{-1}) with the fertilizer dose of 150 kg ha^{-1} while the lowest yield (11.08 t ha^{-1}) was in the treatment having no urea (control). The second cutting showed the similar trends of production. It appears from the results that there were progressive and significant ($P<0.01$) increase in green matter yield of fodder with the increase in N fertilizer doses. The possible underlying reason for increase in the yield of Zamboo grass because of its tremendous response to N fertilizer and it also enhance the growth of Zamboo grass. Earlier investigation by Bali *et al.*[6] indicated similar responses with N application to oat fodder.

Dry Matter (DM): Application of higher doses of N fertilizer had a positive effect on DM yields of Zamboo grass. It appears from the Table 1 that the total DM yield per ha was found to be highest (4.60 t ha^{-1}) for treatment using 150 kg urea ha^{-1} followed by 3.66, 2.75 and 1.85 t ha^{-1} from treatments using 100, 50 and 0 kg urea ha^{-1}, respectively. The effect of N fertilizer was found significant on the yield of DM for both first ($P<0.05$) and second ($P<0.01$) cutting (Table 1 and 2). Similar results have been reported by Khan *et al.*[7] in oat grass, Shahjalal *et al.*[8] in oat and maize grass and Khandaker and Islam[9] in maize grass.

DM contents of Zamboo grass at different N fertilizer doses are shown in Table 3 and 4. The effect of N fertilizer treatment was statistically non-significant for both cutting. This result was consistent with the findings of Reza and Qudoos[10], Khan *et al.*[7], Khandaker and Islam[9].

Crude Protein (CP): Total yield of CP both in first and second cutting at different laves of N fertilizer treatments has been shown in Table 1 and 2. The yield of CP were

Table 1: Effect of nitrogen fertilizer on nutrient yield of Zamboo grass (first cutting)

	Treatments				
Yield (t ha^{-1})	0 kg urea ha^{-1}	50 kg urea ha^{-1}	100 kg urea ha^{-1}	150 kg urea ha^{-1}	Level of significance
Total yield (green basis)	11.08±3.17^{b}	15.63±8.98^{ab}	22.35±5.25^{ab}	26.72±3.48^{a}	**
Dry matter	1.85±0.60^{c}	2.75±1.72^{bc}	3.66±0.85^{ab}	4.60±0.42^{a}	*
Crude protein	0.12±0.03^{b}	0.20±0.12^{ab}	0.30±0.66^{a}	0.39±0.10^{a}	*
Crude Fiber	0.79±0.25^{b}	1.24±0.67^{ab}	1.70±0.30^{a}	2.12±0.38^{a}	*
Ether extract	0.06±0.03^{b}	0.11±0.06^{ab}	0.20±0.05^{a}	0.25±0.07^{a}	**

^{abc}Mean values with different superscripts in the same row differ significantly (P<0.05), * P<0.05, ** P<0.01

Table 2: Effect of nitrogen fertilizer on nutrient yield of Zamboo grass (second cutting)

	Treatments				
Yield (t ha^{-1})	0 kg urea ha^{-1}	50 kg urea ha^{-1}	100 kg urea ha^{-1}	150 kg urea ha^{-1}	Level of significance
Total yield (green basis)	3.94±2.18^{c}	12.24±1.37^{bc}	16.65±1.65^{b}	22.41±3.47^{a}	**
Dry matter	0.67±0.02^{d}	2.13±0.01^{c}	3.08±0.06^{b}	3.97±0.02^{a}	**
Crude protein	0.04±0.01^{c}	0.14±0.01^{bc}	0.24±0.05^{ab}	0.31±0.02^{a}	**
Crude Fiber	0.31±0.02^{d}	1.03±0.04^{c}	1.47±0.05^{b}	1.85±0.20^{a}	**
Ether extract	0.02±0.01^{d}	0.07±0.02^{c}	0.12±0.01b	0.17±0.01^{a}	**

^{abc}Mean values with different superscripts in the same row differ significantly (P<0.05), *P<0.05, ** P<0.01

Table 3: Effect of nitrogen fertilizer on chemical composition of Zamboo grass (first cutting)

	Treatments				
Composition	0 kg urea ha^{-1}	50 kg urea ha^{-1}	100 kg urea ha^{-1}	150 kg urea ha^{-1}	Level of significance
DM (g 100 g^{-1} green grass)	16.68±0.32	17.60±0.9	16.38±0.44	17.45±1.39	NS
CP (g 100 g^{-1} DM)	6.23±0.59^{b}	7.44±0.46^{ab}	8.18^{a}±0.25^{a}	8.41±0.76^{a}	**
CF (g 100 g^{-1} DM)	42.91±3.14^{b}	42.25±1.08^{ab}	46.38^{a}±0.58^{a}	45.39±0.70^{ab}	*
EE (g 100 g^{-1} DM)	3.48±0.66^{b}	4.10±0.41^{ab}	5.39^{a}±0.57^{a}	5.48±0.43^{a}	**
Total ash (g 100 g^{-1} DM)	10.79±0.19^{a}	9.83±0.45^{b}	9.42^{b}±0.14b	9.23±0.50^{b}	**

^{abc}Mean values with different superscripts in the same row differ significantly (P<0.05), NS = Non significant, * P<0.05, **P<0.01

Table 4: Effect of nitrogen fertilizer on chemical composition of Zamboo grass (second cutting)

	Treatments				
Composition	0 kg urea ha^{-1}	50 kg urea ha^{-1}	100 kg urea ha^{-1}	150 kg urea ha^{-1}	Level of significance
DM (g 100 g^{-1} green grass)	16.88±0.01	17.41±0.01	18.47±0.02	17.73±0.01	NS
CP (g 100 g^{-1} DM)	6.43±0.34^{b}	6.80±0.47^{ab}	7.73±0.73^{a}	8.12±0.84^{a}	**
CF (g 100 g^{-1} DM)	45.57±0.76^{b}	48.26±3.46^{a}	47.63±1.89^{a}	46.62±1.42^{ab}	*
EE (g 100 g^{-1} DM)	3.24±0.45^{b}	3.36±0.13^{b}	3.77±0.40^{ab}	4.32±0.32^{a}	**
Total ash (g 100 g^{-1} DM)	8.87±0.66	8.30±0.31	8.91±0.59	9.10±0.46	NS

^{abc}Mean values with different superscripts in the same row differ significantly (P<0.05), NS = Non significant, *P<0.05, **P<0.01

0.12, 0.20, 0.30 and 0.39 t ha^{-1} for first cutting and 0.04, 0.14, 0.24 and 0.31 t ha^{-1} for second cutting treating with urea levels of 0, 50, 100 and 150 kg ha^{-1}, respectively. Analysis of variance showed that the effect of N fertilizer was significant both for first (P<0.05) and second (P<0.01) cutting (Table 1 and 2). Similar results have been reported by Khan *et al.*[7] in oat grass, Lawerence *et al.*[11] in wheat grass and Singh *et al.*[12] in bajra grass. They observed that the higher levels of N fertilizer increase CP yield of the grasses.

The CP content (g 100 g^{-1} DM) of Zamboo grass has been shown in Table 3 and 4 for first cutting and second cutting, respectively. It was found that the CP content increased with the increasing levels of N fertilizer and the effect of N levels was significant (P<0.01) on CP content of Zamboo grass. Similar results have been reported by Tergas and Urrea[13] in Napier grass, Rubio *et al.*[14] in rangeland grass, Kandasmy *et al.*[15] in Guinea grass. On the other hand the percent CP content of the grass was higher in first cutting than that of second cutting which was consistent with the findings of El-Hattab and Harb[16].

Crude Fiber (CF): Total yields of CF at different levels of N fertilizer are shown in Table 1 and 2. CF yields increased significantly with higher doses of N fertilizer application. In first cutting, total CF yields obtained from the treatment using 150kg urea ha^{-1} was the highest (2.12 t ha^{-1}), followed by 1.70, 1.24 and 0.79 t ha^{-1} using the doses of 100, 50 and 0 kg urea ha^{-1}, respectively. The effect of N fertilizer on CF yield was found significant (P<0.05).

CF contents (g 100 g^{-1} DM) of Zamboo grass at different doses of N fertilizer are shown in Table 3 and 4 for first and second cutting, respectively. The CF content influenced significantly (P<0.05) with higher doses of N fertilizer in both first and second cutting. From the results of the present experiment, it was indicated that the CF

content of Zamboo grass for all treatments was higher in second cutting than that of first cutting (Table 3 and 4) and the results were supported by the results found by El-Hattab and Harb[16] who found that the fiber content increased over successive cuts.

Ether Extract (EE): Total yields of EE at different levels of N fertilizer are shown in Table 1 and 2. The effect of N fertilizer on EE yield was found significant ($P<0.01$). EE contents (g 100 g^{-1} DM) of Zamboo grass at different doses of N fertilizer are shown in Table 3 and 4 for first and second cutting, respectively. It was found that with the increasing doses of N fertilizer increase the EE content in both first and second cutting.

Ash: The total ash content of Zamboo grass at different doses of N fertilizer are shown in Table 3 and 4 for first and second cutting, respectively. The total ash content of grass was gradually reduced with increase in the N fertilizer doses. The result was in agreement with the findings of Pieper *et al.*[17]. They reported that there was a lower ash content of fodder with increasing N fertilizer doses.

On the basis of the results of the present experiment, it may be concluded that the production of Zamboo grasses both in first cutting (harvested at 68 days of age) and second cutting (45 days after first cutting) was highest through application of 150 kg urea ha^{-1}. In addition to that the nutrient content of Zamboo grass was also increased with the increasing levels of N fertilizer except ash content. Therefore, 150 kg urea ha^{-1} may be recommended as optimum dose for Zamboo grass production under Bangladesh condition.

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