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Comparison on biomass production of three fodder germplasms

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Abstract

The experiment was conducted to study the comparison on biomass production of fodder germplasm. Para *(Brachiaria mutica* Stapf.), German (*Echinochloa crusgalli* L.) and Dhal (*Hymenachne pseudointerrupta* C. Muell) grasses were cultivated in a completely randomized design (CRD). The whole area was divided into nine plots. The area of each unit plot was 6 m x 6 m. Number of cuttings were 16,000 /hectare where Plant to Plant distance was 16 cm and row and raw distance was 16 cm. Equal amount of organic and chemical fertilizer were applied in all cutting. The fodders were first harvested after 60 days of planting, second and third after successive 60 days of re-growth. The findings of the study showed that fresh biomass ($p<0.01$) and dry biomass yield ($p<0.05$) of three fodder germplasm differed significantly. Crude protein and organic matter yield were significant ($p<0.01$) only in the second cutting. German grass was showed significantly higher in CP and OM yield ($p<0.01$) at second cutting than other grasses. However, no significant effect on plant height was observed among three grasses. From the above findings it may be concluded that among the three fodder germplasm, German fodder showed best result in respect of biomass production.

Key words: Biomass production, Dhal, German, Para,

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Introduction

Bangladesh has an area of 1, 47,570 sq. Km with net cropped area of 1.2 million hectares. There is 0.03 million hectares of cultivable land lying fallow and 0.29 million hectare is unavailable for cultivation. About 80% of the total cultivable land is used for cultivation of cereal crops and only 0.03% for cultivation of fodder crops and the rest for other crops (BBS 2009). Scarcity of animal feeds and fodder has been identified as a major constraint for the development of livestock in Bangladesh. In Bangladesh, cattle live mostly on straw based ration. So livestock development in Bangladesh is mainly depending upon the improvement of animal nutrition through improved feeding and availability of fodder. In this situation, it is of prime consideration to introduce suitable high yielding varieties of perennial fodder crops to the farmers (Ali et al. 1987). On a straw-based diet, supplementation of small amount of green grass is often recommended for optimization of rumen environment (Preston and Leng 1987) or even to meet the maintenance requirement of animal (Ranjhan and Singh 1993). Para, German, and Dhal grass are three important fodder germplasm suitable for production in the context of Bangladesh climate. The most significant feature of these there fodder germplasms is that, they can grow both high and low lands and in water logging condition (Khan 2009). The common fodders available are German, Para, Napier and Dhal. But no research work was undertaken on comparison between these fodder germplasm in respect of productivity, nutritive value etc. To meet up the increasing need of green fodder, it is very much essential to find out some potential fodder germplasm and recommend for extensive cultivation by the farmers for feeding their productive animals. Therefore, the experiment was conducted to compare the biomass production of three fodder germplasms.

Materials and Methods

The climate of the experimental site was characterized by scanty rain and higher temperature during the whole experimental period. The experimental site was in the old Brahmaputra Flood Plain Agro-ecological zone having non-calcareous dark, gray flood plain. The soil was silt loam texture, neutral in reaction (pH 7.0) and contained 0.12% N, 0.07% P and 1.76% organic matter. The experiment was laid out in a Completely Randomized Design (CRD) with three replications in each treatment. There were nine experimental plots having each area of 36 m^2 with a

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distance of 0.15m from plot to plot. The land was prepared by ploughing and cross ploughing four times with bullock-drawn country plough. Lengths of cuttings were 16-18 cm and contain at least 3 nodes in its sheath. Cutting of grasses were planted by line sowing keeping one node under the soil with 45º angles and maintaining a row and plant spacing of 16 cm with a cutting rate of 16,000 cuttings per hectare. At the time of land preparation 130 t/ha cow dung was applied. After 22 days of planting cow dung was applied at the rate of 52 kg/plot. After 30 days of first cutting, cow dung was applied at the rate of 52 kg/plot with 0.25kg of urea. Again after 30 days of 2nd cutting, 52kg of cow dung and 0.35kg of urea were applied per plot. Fertilizer doses were applied in broadcasting methods. Intercultural operations were done as and when necessary.

Three representative samples (long medium and short), from each category were cut down before harvesting. Plant height was measured using measuring tape and weight of the plants were taken.

Fodders were harvested above the ground level (3-5 cm) after 60 days of planting. Green biomass yield from each plot was recorded with the weighing balance. After 60 days of 1st cutting, the fodder was harvested at 60 days interval and fresh biomass yield was also recorded. Then third time fodder was harvested after 60 days of 2nd cutting and fresh biomass yield was recorded.

The data were analyzed using the "MSTAT" statistical program in a Completely Randomized Design, and differences among the treatment means were determined by the Least Significant Difference method (Gomez and Gomez 1984).

Results and Discussion

Morphological description of grass fodders

Morphological characteristics of three fodders are given below.

Para grass

A nutritious, high yielding perennial shrub (Figure 1a), which is relished by cattle. A creeping perennial grass with long, coarse stolons up to 5.0 m. Stems reclining at base, rooting at the lower nodes, to 1 m (3 ft) tall when erect, to 3 m (15 ft) long when creeping; nodes swollen, densely hairy (Figure 1b). Leaf sheaths with dense stiff hairs below, slightly hairy above; leaf blades flat, 10-15 mm (0.4-0.6 in) wide and 25-30 cm (10-12 in) long, glabrous but often with small fine hairs at base above and below:

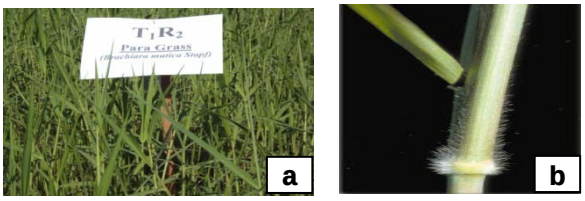

Figure 1. *a) Brachiaria mutica Stapf b) Hairy node and sheath*

German grass

It is a cultivated grass (Figure 2a), popular to all classes of ruminant and non-ruminant animals. Quick growing perennial; found as common weed in low land rice fields. Culms 1 m tall, erect or decumbent at base; blades 5-15 mm wide; panicles 10-20 cm long, nodding (Figure 2b) rather soft, pinkish or pale purple; racemes mostly ascending or apprised, the lower somewhat distant; spikelets about 3-3.5 mm long. *Echinochloa colona* (jungle rice) closely resembles *Echinochloa crus-galli* (barnyard grass), especially when *Echinochloa colona* are more vigorous. It can be differentiated from *Echinochloa colona* by the presence of numerous spines (hairs) on its spike lets along the nerves (Felger, 1990).

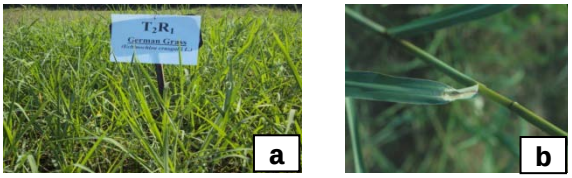

Figure 2. *a) Echinochloa crus-galli (L.) b) Node and sheath*

Dhal grass

A perennial, stoloniferous grass (Figure 3a), with robust, erect or ascending culms 1-2.5 m high and to greater than 12 mm thick, and prostrate stems that run on wet ground, or float on water, developing adventitious roots. Stems glabrous (Figure 3b), pithy. Leaves glossy green in colour, sheaths often spongy; blades mostly 10-45 cm long and to >3 cm wide, cordate, auriculate and clasping (amplexicaul) at base; ligule membranous. Caryopsis easily detached 1-2 mm long and 0.6 mm diameter. *H. amplexicaulis* is morphologically similar to *H. acutigluma* (Steud.).

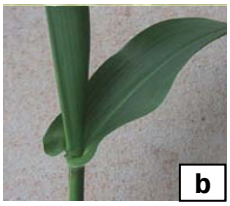

Figure 3. *a) Hymenachne pseudointerrupta C. Muell b) Node and sheath*

Biomass yield of different germplasms

The yield of Para, German and Dhal grass cultivated under same condition in respect of fresh biomass yield, dry biomass yield, crude protein yield and organic matter yields have been shown in Table 1.

It was observed that average plant heights of these three grasses were not significantly differed but average height of German grass was higher than other two grasses. This is due to the high genetic potentiality of German grass to utilization of soil nutrient more rapidly than other grasses. According to the Jesmin (2009) plant height of Para and German grass was 140.97 and 154.15 cm which were almost similar with this study. The highest plant height in German fodder (2.4 m) was also found by Pikar (2010) who worked with nineteen different fodders germplasms. James (1983) reported that plant height of German grass is 1.5 m which is similar with the present study.

The present study revealed higher productive ability of German grass in all stages of maturity were significant ($p<0.01$) (Table 1). Increased may be due to its positive response to organic manure (cow dung) and nitrogen fertilizer. The results obtained in the present study were similar to the findings of Pikar (2010) who found that total yield of fresh biomass of German grass was significantly ($p<0.01$) higher compared to Dhal and Para grass. Other studies have also indicated the total biomass yield of German grass in both cuttings progressively and significantly ($p<0.01$) increased compared to other grasses (Pervin 2004; Malak 2005). Earlier investigation reported similar responses to oat forage (Barik et al. 1998; Choubey et al. 1999; Singh et al. 1997). Production of Dhal grass was slightly lower compared with the findings of Hannan (2004), who found that 24.44±2.03 MT/ha in the first cutting and 22.22±2.03 MT/ha in the second cutting.

Table 1. Plant Height, fresh biomass, dry biomass, CP and OM yields of three fodder germplasms at different cuttings

Fodders Name			Para	German	Dhal	Sig. level
First cutting	Plant height (cm)		102.4± 4.04	137.9±4.14	117.6±6.64	NS
	Yield (TM/ha)	Fresh Biomass	16.78^{c}±1.029	20.29^{a}±2.06	17.98^{b}±1.00	**
		Dry Biomass	3.38b±0.48	5.06^{a}±0.30	3.30^{b}±0.65	*
		CP	0.29±0.03	0.37±0.03	0.29±0.05	*
		OM	3.08±0.53	3.77±0.19	2.98±0.62	NS
Second cutting	Plant height (cm)		133±4.0	144±2.6	129±6.5	NS
	Yield (TM/ha)	Fresh Biomass	17.8^{b}±0.9	22.4^{a}±1.3	15.6^{c}±1.0	**
		Dry Biomass	3.9b±0.7	5.17^{a}±0.4	3.79^{b}±0.3	*
		CP	0.27^{b}±0.04	0.35^{a}±0.03	0.23^{c}±0.01	**
		OM	3.4b±0.3	3.6a±0.3	2.5^{c}±0.1	**
Third cutting	Plant height (cm)		149.02±6.50	148.15±4.72	121.08±7.37	NS
	Yield (TM/ha)	Fresh Biomass	23.00^{b}±2.00	26.75^{a}±1.63	19.06^{c}±1.06	**
		Dry Biomass	4.80^{b}±0.1	5.47^{a}±0.6	4.06^{b}±0.5	*
		CP	0.30±0.05	0.37±0.06	0.24±0.02	*
		OM	3.4±0.5	3.13±0.52	2.8±0.15	NS

*Means with different superscripts in the same raw differ significantly; NS, non significant; *, $p<0.05$; **, $p<0.01$*

Significant ($p<0.05$) difference was found among Para, German and Dhal grass in all stages of maturity. It was observed in this study that total DM yield of German grass was higher in all three cuttings. The dry biomass yield of Para and Dhal grass was 5.55 and 5.69 MT/ha found by Pikar (2010) which is slightly higher than the present study. Hannan (2004) reported that fresh DM yield of Dhal grass was 2.38 and 4.41 MT/ha in the first and second cutting respectively which was nearly similar to the present study. Malak (2005) showed that dry biomass yield of German grass was 2.28 MT/ha in 60 days of cutting which gave lower production value than present study. The result of the present experiment was also similar with the findings of Pervin (2004), Singh et al. (1997) and Choubey et al. (1999).

From the present study it was observed that, CP yield of Para, German and Dhal grass has no significant variation at first and third cuttings. But the results showed that crude protein yield was higher in German grass than Para and Dhal grass in first and second cutting. Whereas in the third cutting it was slightly higher than Para grass. Significantly ($p< 0.01$) higher crude protein yield were observed in German grass when compared with Para and Dhal grass in the third cutting. This results was in agreement with the findings of Pikar (2010) who observed that higher CP yield (0.79 and 0.83 MT/ha in first and second cutting) in German grass compared to Para grass (0.45 and 0.46 MT/ha in first and second cutting) and Dhal grass (0.49 and 0.32 MT/ha in first and second cutting). The present findings gave higher results when compared with the findings of Pervin (2004) who found that 0.12 and 0.14 MT/ha CP in first and second cutting in case of German grass. The present result is also similar to Hannan (2004) and Mondol (2008) in case of Dhal grass.

It was observed that there was significant ($p<0.01$) effect present in German grass when compared with Para and Dhal grass. There was no significant effect observed in first and second cutting but the result showed that OM of German grass was higher than Para and Dhal grass in all cuttings. The result was almost similar to the findings of Jesmin (2009) who showed that OM content of Para and German were 90.36± 1.04 and 89.55±0.71% respectively. Hannan (2004) found similar organic matter yield in Dhal grass.

Correlation between Plant height and biomass yield

Medium correlation ($R^2=0.5752$ in Figure 1) between plant height and biomass yield was observed in each cutting. This means that biomass production was increased with the increase of plant height.

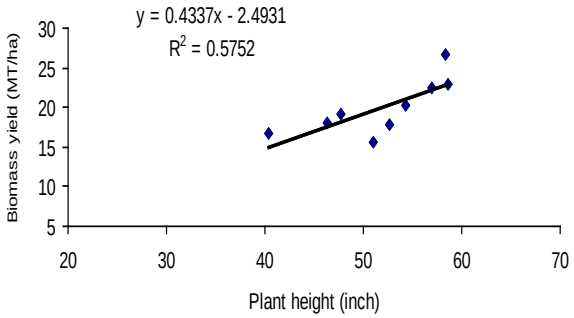

Figure 1. *Correlation between plant heights and biomass yield*

Conclusion

In considering biomass production of three fodder germplasm, it may be suggested that German, Para and Dhal fodder is suitable for animal production but German fodder is more suitable among the three fodder germplasms.

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