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EFFECT OF CUTTING HEIGHT ON DRY MATTER YIELD AND NUTRITIVE VALUE OF BURGUNDY BEAN (*Macroptilium bracteatum*)

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ABSTRACT

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The experiment was conducted at the Screen House of Agronomy Department, Bayero University Kano, to determine the effect of cutting height on dry matter yield and chemical composition of burgundy bean (*Macroptilium bracteatum*). The treatments were three cutting heights (5, 10 and 15 cm) repeated five times in completely randomized design. Burgundy seeds were scarified by immersing in hot water at a temperature of 80 °C for 3 minutes to break dormancy. Seeds were later sown in plastic containers (width 21.5 cm, base width 15.5 cm and 20 cm height) each containing 5kg soil/sand mixture at ratio 3:1. Seedlings were thinned to 5 stands per pot at three weeks post sowing. At eight weeks post sowing the plants were uniformly mowed to a constant stubble height of 5 cm, thereafter the plants were harvested according to the designated cutting heights of 5, 10 and 15 cm stubble heights at four weeks interval, an average of 3 cuts were taken. Harvesting was done at 12% flowering of burgundy bean. The following parameters were measured: Total dry matter yield (TDM), morphological characteristics (root dry weight, number of nodules, leaf to stem ratio, leaf area and plant height) and forage quality parameters such as crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), ash, digestible dry matter intake (DMI) and relative feed value (RFV). Result of the study revealed that there were no significant differences among the parameters measured. However, differences were observed in numerical values. Total dry matter yield and crude protein were higher in burgundy bean cut at 15 cm compared to 5 and 10 cm. Morphological characteristics values were observed to be numerically higher at 5 cm cut across all parameters compared to 10 and 15 cm. Other quality parameters such as ash, dry matter intake (DMI) and relative feed value (RFV) were observed to be higher at 5 cm cut than 10 and 15 cm. In addition, neutral detergent fiber (NDF) was lowest at 5 cm. As a compromise between dry matter yield and forage quality, it can be concluded that burgundy bean be cut at 5 cm from the soil surface during harvest.

INTRODUCTION

Livestock production in Nigeria depends on natural pasture with low yield and poor quality (Onwuka et al., 1989; Abubakar and Mohamed, 1992; Osagie, 1998). Poor nutrition is a major constraint to livestock production in small-holder crop-livestock farming system, especially during dry season when available

feed quantity is low and quality extremely poor (Alhassan, 1987)..

Legumes such as, *Stylosanthes guianensis*, *Lablab purpurens*, *Stylosanthes humata* and *Centrosoma* species have proven very valuable in improving the quality of pasture (Agishi and De Leew 1987).

In most grass-legume mixtures, the legume tends to be at the receiving end considering the growth rate of the grass which constitutes a shade for the legume there by reducing its productivity. It was hypothesized that one factor that can affect the productivity and nutritive value of forages is its cutting height. Furthermore, there is the need to evaluate more elite legume species to ascertain their performances. One of such species is burgundy bean (*Macroptilium bracteatum*). Burgundy bean is a palatable perennial erect and trailing pubescent herbaceous legume whose potential has not been realized in Nigeria given the fact that it is relatively new to this clime. It has high crude protein, digestibility and mineral contents but lower fiber when compared to other legumes (Tarawali et al, 1997) The experiment was therefore designed to evaluate the effects of cutting height on the productivity and nutritive value of burgundy bean (*Macroptilium bracteatum*).

MATERIALS AND METHODS

Experiment Location:

The experiment was conducted at the Screen House of Agronomy Department, Faculty of Agriculture Bayero University that lies between longitude 9° 30' and 12°30'N and latitude 12° 30' E (KNARDA, 2001). Average annual rainfall in Kano is about 690mm with temperature range from 21 to 39°C. Analysis of soil in the experimental area revealed a sandy loam soil with the following elemental composition (N=0.35%, P= 7.908 mg/kg and K= 0.3cmol/kg).

Treatments Experimental Design and Field Culture

The treatments were three cutting heights (5, 10 and 15cm) repeated five times in a completely randomized design. Burgundy seeds were scarified by immersing in hot water at a temperature of 80 °C for 3 minutes to break dormancy. Seeds were later sown in plastic containers with the dimensions (width 21.3 cm, base width 15.5 cm and 20 cm height) containing 5kg soil/sand mixture at the ratio of 3:1. At three weeks post sowing seedlings were thinned to 5 stands per pot. The plants were uniformly cut to a stubble height of 5 cm to the soil level at exactly 8 weeks post

sowing, thereafter harvesting was done on 4 weekly basis by cutting the plant stands to the desired height of 5, 10 and 15cm to the soil level. An average of three cuts was taken. Harvesting was done at 12 % flowering of burgundy bean.

Morphological Characteristics and Dry Matter Yield Estimation

Morphological characteristics such as root dry weight was measured by washing the root free of soil under running tap and oven dried at 65°C for 72 hr. Number of nodules determined by physically counting the number of nodules on the roots, leaf to stem ratio by separating the leaf from stems and then weighted on fresh and dry weight basis, Leaf area using the leaf area meter (model YMJ-A Portable) and plant height by measuring with a tape from the base of the plant to the tip of the highest leaf. Total dry matter yield was measured by weighing the freshly harvested sample of burgundy bean and oven dried at 65°C for 72 hr. The dry matter yield was calculated based on the assumption that 1 ha of land is equivalent to 2,000,000 kg of soil

Chemical Analysis and Calculation of other Nutritive Value Indices:

Crude protein (CP) was determined according to Kjeldahl's method of Nitrogen determination. The nitrogen content was first determined and then multiplied by factor (6.25) to arrive at the percentage crude protein. Acid and neutral detergent fibers (ADF and NDF respectively) were determined according to the procedures described by Van Soest et al (1991). Ash by gravimetric incineration method according to (AOAC, 1995). Digestible dry matter (DDM), dry matter intake (DMI) and relative feed value (RFV) were calculated as thus:

DMI = 20/ % NDF dry matter basis, (Horrocks and Vallentine, 1999)

DDM = 88.9 – (0.779 x % ADF, dry matter basis), (ditto)

RFV = % DDM x DMI x 0.775 (ditto)

Data Analysis

The data obtained were analyzed by Analysis of Variance (Anova) using SAS package (Version 9.2 of 2009). While differences among means were separated using least significant difference (P < 0.01 or 0.05).

RESULTS**Morphological characteristics and dry matter yield of Burgundy bean as affected by cutting height.**

The result presented in the Table 1 indicated no significant differences ($P>0.05$) in all the parameters measured among cutting heights. However, the total dry matter yield tended to be higher in numerical value at 15 cm cut (3760

kg/ha) compared to 5 cm (3400 kg/ha) and 10cm (2120 kg/ha). Higher numerical values were obtained at 5cm cut compared to cut at 10 and 15cm. in terms of morphological characteristics, The higher values were recorded in root dry weight (19 g), number of modules (23.20) leaf-stem ratio (0.89). Leaf area (31.68 cm²) and plant height (59.74 cm)

Table 1. Dry matter yield and morphological characteristics of burgundy bean at three levels of cut

Treatment	TDM (kg/ha)	RDW (g)	NN	Leaf/steam ratio	LA (cm ²)	PH (cm)
T1 (5 cm)	3400	1.90	23.20	0.89	31.68	59.74
T2 (10 cm)	2120	1.68	11.80	0.81	24.67	45.72
T3 (15 cm)	3760	1.79	17.40	0.77	26.91	57.72

TDM=Total dry matter yield, RDW= Root dry weight NN= Number of nodules, LA=Leaf area, PH= Plant height.

Nutritive value of Burgundy bean cut at different levels.

The results in Table 2 indicate no significant difference ($P>0.05$) in the nutritive value indices of burgundy bean irrespective of height of cut, however, crude protein tended to be higher at 15 cm cut (16.59%) compared to

5 cm (16.23 %) and 10 cm (15.64 %). Numerically, ADF was higher at 5 cm cut (30.25 %) while NDF and DDM at 10 cm (16.68 and 67 %, respectively). Percentage ash, DMI and RFV were observed to be higher in absolute terms at 5 cm cut (7.64 %, 2.10 % and 106.27 %, respectively).

Table 2: Nutritive value indices of burgundy bean (%) at three levels of cut

Treatment	CP	ADF	NDF	Ash	DDM	DMI	RFV
T1 (5 cm)	16.23	30.25	57.40	7.64	65.34	2.10	106.27
T2 (10 cm)	15.64	27.00	61.68	6.59	67.87	1.96	102.71
T3 (15 cm)	16.59	29.30	59.58	5.42	66.08	2.02	103.09

DISCUSSION

Cutting height is one of the factors determining the productivity and quality of forage plants. The non-significant difference recorded among cutting heights (5, 10 and 15 cm) agrees with the report of Thinnakon et al, (1995) who found no significance in the production of Napier grass cut at 30 days interval at 5, 10 and 15 cm stubble heights. However, Sumran et al, (2009) observed that the total and average dry matter yields were significantly higher at 15 cm cut than 5 cm in King Napier, this may probably explain the numerically higher dry matter yield at 15 cm cut compared to other cuts observed in the current study.

The seemingly higher root weight recorded at 5 cm cut (Table 1) may be explained in the context of higher leaf area as higher leaf area connotes higher ability to capture solar radiation for photosynthesis which supplies the photosynthate for root development. The higher number of nodules at 5 cm cut may have been aided by numerically higher root mass and suggestive of greater ability to fix nitrogen from the atmosphere.

The proximate composition of burgundy bean was affected by height of cut. Sumran et al, (2009) recorded no significant difference in the crude protein and dry matter digestibility of King Napier harvested at 3 cutting heights.

Similarly, Nakamane et al, (1996) observed no significant difference in CP and ADF of Napier grass cut at 0, 7.5 and 15 cm. However, significant differences were found in terms of NDF (Nakamane et al, 1996 and Sumran et al., 2009) as well as ADF and ash (Sumran et al., 2009) which contrast with the result of the current study. The seemingly higher dry matter intake as a percentage of body weight observed at 5 cm cut could be explained in term of comparatively lower NDF value obtained at the same level of cut. In the same vein, digestible dry matter was observed to be lower at 5 cm cut compared to 10 and 15 cm by virtue of higher ADF value recorded at 5 cm

cut. As a compromise between dry matter yield and forage quality, burgundy bean should be cut at 5 cm stubble height during harvest due to moderate dry matter yield, numerically higher root weight, nodulation, leaf to stem ratio, leaf area and plant height coupled with higher forage quality indices such as ash DMI and RFV.

Conclusion

As a compromise between dry matter and forage quality, it can be concluded that burgundy bean be cut at 5 cm from the soil surface during harvest.

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