CHEMICAL COMPOSITION OF *BRACHIARIA RUZIZIENSIS* AS INFLUENCED BY FERTILIZER RATE, PLANT SPACING, AND HARVEST AGE

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ABSTRACT

The study was aimed to evaluate the chemical composition of Brachiaria ruziziensis forage as influenced by fertilizer rate, plant spacing, and harvest age. The study was a 3 x 2 x 2 factorial arrangement with 3 fertilizer rates of NPK 15:15:15 (0, 120, and 240 kgN ha-1), 2 plant spacing (0.5m x 0.5m and 1.0m x 1.0m), and 2 age at harvest (8 and 10 weeks after planting (WAP). The proximate and fibre fractions of the forage based on different treatments were determined. Results showed that fertilizer rates significantly (P<0.05) increased the crude protein (40%) and ash (11.42%) contents of B. ruziziensis that received 240kgN ha-1, while higher crude fibre (16.45%) was recorded in B. ruziziensis with fertilizer rate of 120 kgN ha-1. Sowing of the grass at an interval of 1.0 m2 recorded a higher significant (P<0.05) effect on ether extract (EE) (4.82%). The highest values for acid detergent lignin (16.78%), acid detergent fiber (48.23%), neutral detergent fiber (63.79%), cellulose (31.45%), and hemicellulose (63.79%), as influenced by harvest age, were recorded for the grass sowed at 1.0m2. In conclusion, the application of fertilizer at 240kg N/ha rate, spacing of 1.0m2, and harvested at 10 weeks promotes better nutrient quality of Brachiaria ruziziensis grass.

Keywords: *Brachiaria ruziziensis*, age at harvest, grass spacing, fertilizer rates, and nutritive quality.

INTRODUCTION

Tropical agricultural production faces the challenges of balancing profit with satisfying environmental requirements and regulations; as such, plant productivity and methods for raising animals need to be improved due to the increasing need for animal-based protein and the intensifying demand for farmland. (Godfray *et al*., 2010; Taube *et al*., 2014). In the tropics, natural pasture provides a significant feed base for ruminant animals, resulting from lower cost and very little or no professional skills to drive feed sourced from the natural pasture compared with purchased or processed feeds (Dillon *et al*., 2005). According to Clark *et al*. (2001) and corroborated by Lee *et al*. (2017), various management options help to enhance the productivity of the natural pasture, such as application of nitrogen fertilizer and irrigation, which often come at the risk of indiscriminate grazing by nomadic herders, thereby jeopardizing possible investment pasture establishment. However, to overcome some of the limitations of the natural pasture and maintain the profitability and competitiveness of pasture production, there is a need to cultivate, manage, and use pastures essentially managed using various agricultural procedures like fertilizer application, spacing, and harvest age to promote productive and efficient livestock production. Therefore, this study will evaluate the chemical composition of *Bracahiaria ruziziensis* forage as influenced by fertilizer rate, plant spacing, and harvest age.

MATERIALS AND METHODS

Experimental site

The study was conducted at the Pasture unit of the Directorate of University Farms (DUFARMS) and the laboratory of the Department of Pasture and Range Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria.

Land Preparation

The total land area of 361m^2 was mapped out and established as an experimental field. The experimental plots were outlined in a 5m x 5m for the main plot, 5m x 2m for the sub-plot, and 2m x 2m for the sub-sub-plot with a spacing of 1m between the main plots and between replicates.

Sourcing of Planting Material, and Planting

Bracahiaria ruziziensis seeds were purchased from the National Animal Production Research Institute (NAPRI), Ahmadu Bello University (ABU), Zaria. The seeds were drilled at 0.5m and 1.0m on the respective plots at the rate of 12kg ha-1 and well labeled.

Determination of Proximate Composition

The dry matter (DM), crude protein (CP), ether extract (EE), and ash of the hay samples were determined according to AOAC (2000), while non-fiber carbohydrates (NFC) components and estimated as NFC = 100 – (CP + EE + NDF + ash).

Determination of Fibre Fractions

The neutral detergent fibre (NDF), acid detergent fibre (ADF), and acid detergent lignin (ADL) of the samples were determined according to the procedure by Van Soest *et al*. (1991). ADF Cellulose was calculated as the difference between ADF and ADL, while hemicellulose was calculated as the difference between NDF and ADF.

Statistical Analysis

The laboratory data collected were subjected to a 2-way analysis of variance using the SAS (1999) package with means separated using Duncan's Multiple Range Test at $P<0.05$ (Duncan, 1955).

RESULTS AND DISCUSSION

The proximate composition percentage (%) of *Bracahiaria ruziziensis* as affected by the fertilizer rates, plant spacing, and age at harvest is presented in Table 1. The results show that fertilizer rates significantly ($P<0.05$) affected the proximate composition (ash, crude protein, and crude fiber) of *B. ruziziensis* except for dry matter (DM) and ether extract (EE), while spacing had a significant effect on dry matter (DM) and ether extract (EE).

Table 1: Main effects of fertilizer, age at harvest, and spacing on the proximate composition of *Bracahiaria ruziziensis* hay

TREATMENTS	DM	EE	ASH	CP	CF
FERTILIZER APPLICATION RATE					
0kg	91.93	4.68	7.33^{b}	9.05^{b}	16.16^{a}
120kg	92.21	4.55	7.32^{b}	8.93^{b}	16.47^{a}
240kg	91.50	4.54	11.42^{a}	15.40^{a}	14.47^{b}
SEM	0.20	0.04	1.36	2.13	0.62
AGE AT HARVEST					
8 weeks	91.98	4.58	8.61	10.80	16.10
10 weeks	91.77	4.60	8.77	11.46	15.30
SEM	0.10	0.01	0.08	0.33	0.40
SPACING					
0.5	92.28^{a}	4.36^{b}	7.91	10.24	15.78
1.0	91.48^{b}	4.82^{a}	9.47	12.01	15.61
SEM	0.40	0.23	0.78	0.88	0.08

a,b, and ab means in each column with different superscripts are significantly different ($p<0.05$). DM = Dry Matter, EE = Ether Extract, CP = Crude Protein, CF = Crude Fibre. SEM = Standard Error of the Mean.

Ben Romdhane (2022), reported a crude protein value of 9.32-13.05% for vetiver grass treated with nitrogen fertilizer, which is similar to the result in this study. However, the ether extract recorded in this present study was lower than the values of 4.58% - 6.08% reported by Ewetola *et al*. (2020) for two fertilized tropical grass species harvested at different stages of growth during the wet season.

The fibre fractions (%) of *Bracahiaria ruziziensis* as influenced by fertilizer rates, age at harvest, and spacing are presented in Table 2. The results show that the fertilizer rates have a significant ($P<0.05$) effect on hemicellulose at 120kg N/ha-1. Also, spacing had significant ($P<0.05$) effects on fibre fractions (ADL, ADF, NDF, cellulose, and hemicellulose) of *B. ruziziensis* forage.

Table 2: Main effect of fertilizer types, age at harvest, and spacing on the fiber fractions (%) of *Bracahiaria ruziziensis*

Parameters	ADL	ADF	NDF	Cellulose	Hemicellulose
Fertilizer					
0kg	16.28	44.57	61.99	28.28	17.42[a]
120kg	16.04	44.48	62.28	28.44	17.79[a]
240kg	16.19	47.46	61.71	31.27	14.24[b]
SEM	0.07	0.97	0.16	0.97	1.12
Age at harvest					
8weeks	16.03	44.86	61.67	28.82	16.81
10 weeks	16.30	46.15	62.31	29.84	16.16
SEM	0.13	0.64	0.32	0.50	0.32
Spacing					
0.5	15.56[b]	42.78[b]	60.20[b]	27.21[b]	60.20[b]
1.0	16.78[a]	48.23[a]	63.79[a]	31.45[a]	63.79[a]
SEM	0.61	2.72	1.79	2.12	1.79

a,b means that each column with different superscripts is significantly different ($p < 0.05$). ADL= Acid Detergent Fibre, ADF= Acidic Detergent Fibre, NDF= Neutral Detergent Fibre. SEM = Standard Error of the Mean.

The crude fiber content recorded in this study was lower than the values (14.33-30.75%) reported by Falola and Olufayo (2017). Neutral detergent fibre (NDF) values (44.33-54.89%) recorded in this study were comparable to the values of hybrid *Urochloa* cv Mulato II grass (42.10-52.80%) reported by Tadesse *et al*. (2021b) who reported that NDF values in their study were as a result of plant spacing and fertilizer levels. The acid detergent fiber (ADF) recorded in this study was higher than the ADF content of 30.75-36.75% reported for two fertilized tropical grass species harvested at 6 and 8 weeks of growth during the wet season (Ewetola *et al*., 2020). The observed differences could be attributed to different grass species and differences in age at harvest. In addition, the hemicellulose content values (8.81-10.34%) recorded in this study were higher compared to the ones reported by Ewetola *et al*. (2020) (19.75- 26.00 %) for two fertilized tropical grass species harvested at 6 and 8 weeks of growth during the wet season. These differences could be attributed to different grass species and differences in age at harvest as reported by Osafo *et al*. (2023), who stated that age at harvest influences plant fractions, indicating that as forage plants age, dry matter generally increases while concomitant cell wall contents increased as well.

CONCLUSION

In conclusion, this study suggests that a fertilizer application rate of 240kg N/ha-[1] at a spacing of 1.0m and harvested at 10 weeks promotes better forage quality in *Brachiaria ruziziensis* forage.

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