

YIELD AND PROXIMATE COMPOSITION OF *BRACHIARIA RUZIZIENSIS* FERTILIZED WITH GOAT MANURE AS POTENTIAL DRY SEASON FORAGE FOR RUMINANTS

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ABSTRACT

This study was conducted to evaluate the dry matter yield and proximate composition of irrigated *Brachiaria ruziziensis* as influenced by different rates of goat manure application during the dry season. Five treatments comprising of *Brachiaria ruziziensis* fertilized with 5, 10, 15, 20 t/ha dry matter (DM) goat manure (GM) and the control were arranged in a randomized complete block design with five replicates. The grass was cut back to 15 cm stubble height at the commencement of the study followed by harvesting of three random quadrat samples of 45-days regrowth for determination of yield and nutrient composition. The dry matter yield ranged from 1.88 to 5.26 t/ha and was highest for plots fertilized with 20 t/ha DM GM and least for control. The crude protein content of *B. ruziziensis* increased significantly ($P < 0.05$) with increased manure application rates. Plot fertilized with 20 t/ha DM GM had the highest value (9.28 %) while the control had the least value (7.59%). It can be concluded that goat manure application rate of 20 t/ha DM had the better potential to increase dry matter yield and proximate composition of irrigated *B. ruziziensis* during the dry season.

Keywords: Goat manure, forage yield, proximate composition, *B. ruziziensis* and ruminant

INTRODUCTION

Natural grasslands constitute the major feed resources of ruminants, either by grazing or as conserved forages. However in the tropics, the inadequacies of feed and its low nutritive quality during the dry season are major limitation to successful ruminant production (Fasae *et al.*, 2019). Most of the animals suffer from seasonal nutritional stress, resulting in weight loss, reproductive inefficiency and even death (Yohanna *et al.*, 2015). This seasonal shortage can be mitigated by the use of sown forage of better nutritional value and purposely managed. High quality grass forage like *Brachiaria ruziziensis* have been reported as perennial tropical forage which is easy to establish and respond well to nitrogen fertilization (Skerman and Riveros, 1990). However to maintain the quality and year round production, there is need for water and nutrient to be supplied especially during the dry season to enable continuous production. Thus providing quality forage for ruminant to enhance their growth and provide maximum profit for farmers throughout the year. In Nigeria despite government interventions, inorganic fertilizers still remain expensive, in lieu of this researchers have shifted attention to examine the performance of crops with organic manure which is cheap, readily available, biodegradable and environmentally friendly. Organic manure has been discovered to be rich in nutrients which increase crop growth rate, yield, quality, and the ability to tolerate stressful conditions (Nweke *et al.*, 2013). This study was designed to evaluate the effect of different goat manure rate on yield and nutrient composition of irrigated *Brachiaria ruziziensis* as potential dry season forage for ruminants.

MATERIALS AND METHODS

The experiment was conducted at the Kalahari Red goat unit of the Institute of Food Security, Environment Resource and Agricultural Research Farms of the Federal University of Agriculture, Abeokuta, Nigeria, situated in the humid tropics. *B. ruziziensis* was established by planting the seeds using a drill method in June 2015. Prior to manure application, soil samples were randomly collected

from the plots, air-dried, sieved with a 2 mm mesh sieve and analyzed for physical and chemical properties through methods reported by Osayande *et al.* (2015) while goat manure (GM) was also collected from the goat unit of the experimental site for analyses. Necessary manure rates were applied before the commencement of the experiment by making a small farrow about 4–8 cm from the base of the plant then manure applied and farrow closed back and irrigation of the plots to fill capacity started 7 days before the commencement of the experiment at three-day interval. The experiment was laid out in randomized complete block design with five treatments comprised of *B. ruziziensis* fertilized with 5, 10, 15, 20 t/ha dry matter (DM) GM and the unfertilized plot. Each treatment was replicated five times. The plants were undefoliated before the initial cut-back to a stubble height of 15 cm at the start of the experiment in December 2015. Each plot measure 4 m by 4 m with an inter plot space of 0.5 m. Dry matter yield was estimated after 45-day regrowth by throwing a $1.0 \times 0.5 \text{ m}^2$ quadrant frame thrice in each plot and the entire sward falling inside it harvested manually using a sickle to stubble height of 15 cm and weighed fresh, sub samples were taken and oven dried at 65°C till constant weight for determination of dry matter yield. The dry matter, crude protein, ash and ether extract were determined according to AOAC (2005) and data obtained were subjected to analysis of variance using the statistical package SAS (2003) and means were separated using least significant difference (LSD) of the package.

RESULTS AND DISCUSSION

The soil and goat manure composition are shown in Table 1. The composition of goat manure (GM) observed in this study was lower in total nitrogen, organic matter, phosphorus and potassium values reported by Awodun *et al.* (2007) but higher than that reported by Odedina *et al.* (2011). The differences in nutrient content of GM could be related to the nutritional management of goats.

Table 1: Chemical analysis of soil and goat manure sample

Parameters	Soil	Parameters	Goat manure
pH in water	8.15	pH in water	8.07
% Total nitrogen	0.14	Total nitrogen (%)	1.55
% Organic carbon	0.60	Organic carbon (%)	13.07
% Organic matter	1.03	Organic matter (%)	45.41
Av. phosphorus (mg/kg)	16.10	Phosphorus (%)	0.22
K ⁺ (Cmol/kg)	0.84	Potassium (%)	0.87
Na ⁺ (Cmol/kg)	0.71	Sodium (%)	0.28
Ca ²⁺ (Cmol/kg)	3.13	Calcium (%)	1.27
Mg ²⁺ (Cmo/lkg)	1.46	Magnesium (%)	1.36
Exch. acidity (Cmolkg ⁻¹)	2.70		
% Sand	76.90		
% Clay	17.80		
% Silt	5.30		

Goat manure application rates was found to have significant effect ($P < 0.05$) on the dry matter yield of *B. ruziziensis* (Figure 1). The highest DMY of 5.26 t/ha was recorded for treatments fertilized with 20

t/ha DM GM while the least DMY of 1.88 t/ha was recorded for control. The results of this study revealed that DMY of *B. ruziziensis* increased with increased rate of goat manure application. This agrees with the finding of Maleko *et al.* (2015) who observed that dry matter yield of *B. ruziziensis* increased significantly from 9.31 to 13.70 t/ha as cow manure application rate increased from 0 to 15 t/ha DM. This increase in DMY with increased manure application could be attributed to increasing large amount of goat manure added to the soil and slow nutrient release from the manure particularly nitrogen (N) which is known to plays a major role in leaf growth. The DMY in this study was higher than the yield (1.87 t/ha) reported by Panchaban *et al.* (2005) but lower than that reported (21.5 t/ha) by Naveh and Anderson (1967) and (17.6 t/ha per year at 800 kgN/ha per year application) by Skerman and Riveros (1990). The observed variations in yield of *B. ruziziensis* under these studies compared to others might be due to time of data collection, age at cut, season variation, type and rate of fertilizer/manure applied and soil fertility.

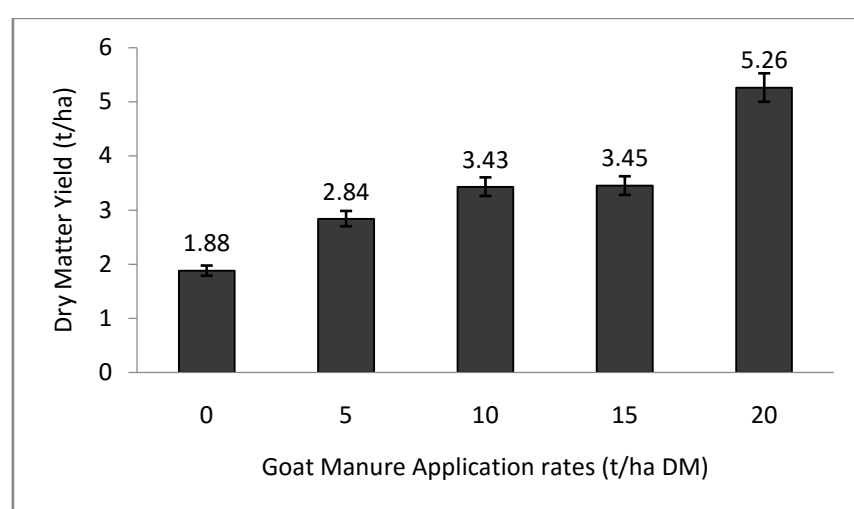


Figure 1: Effect of goat manure application rates on dry matter yield (t/ha) of *B. ruziziensis*

Dry matter (DM) and ash content were not significantly influenced by the manure application rates (Table 2). Olanite *et al.* (2014) reported similar DM value for grasses in their experiment. The crude protein (CP) content and ether extract (EE) content were significantly influenced ($P < 0.05$) by the manure rates (Table 2). The EE content ranged from 4.49 % in the control to 5.73 % in treatment fertilized with 20 t/ha goat manure. Crude protein content ranged from 7.59 in unfertilized plots to 9.28 % in plots fertilized with 20 t/ha DM goat manure. Also plots fertilized with 10, 15 and 20 t/ha goat manure was observed to be significantly higher than the control. Despite these variations, the forage generally had adequate amount of protein to meet ruminant requirement. The CP contents of *B. ruziziensis* in this experiment were consistently above the critical limit required for maintenance by ruminants. According to Minson (1990), if the CP content of a feed is lower than 7%, animal performance could decline due to low voluntary intake, lower rate of digestibility and negative nitrogen balance. The highest CP values were recorded for *B. ruziziensis* fertilized with 20 t/ha DM goat manure is an indication of a more positive effect of increased goat manure rate on the grass during the experiment. This might be attributed to more organic matter decomposition, and quicker release of nutrients, in the form of nitrogen and phosphorous for plant uptake because of the higher quantity added.

Table 2: Proximate composition (%) of *Brachiaria ruziziensis* using different goat manure application rates

Treatments (t/ha DM)	Dry Matter	Crude Protein	Ether Extract	Ash
Control	37.15	7.59 ^d	4.49 ^{ab}	8.37
5	40.86	8.10 ^{cd}	4.65 ^{ab}	8.42
10	39.50	8.17 ^{bc}	3.75 ^b	8.51
15	41.84	8.69 ^b	5.32 ^a	8.77
20	42.70	9.28 ^a	5.73 ^a	9.33
SEM	0.96	0.17	0.26	0.27

^{abcd} Means on the same column having different superscripts were significantly different (P<0.05)

SEM, Standard Error of Mean

CONCLUSION

The study showed that dry matter yield and proximate composition of irrigated *Brachiaria ruziziensis* fertilized with 20 t/ha DM goat manure produced the best quality forage. This could facilitate year-round production of forage and a safer environment with sensible and efficient use of goat manure.

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