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Yield, Mineral Content and Nutritive Value of *Panicum maximum* Cv T58 in the Derived Savanna Zone of Nigeria

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Abstract: *Panicum maximum* cv T58 was evaluated in the derived savanna zone of Nigeria for its yield and nutritive value when fed to the WAD sheep. The agronomic experiment was a split plot design with fertilizer Nitrogen levels (0, 100, 200 and 400 KgN/ha) as main plots. Each was replicated thrice and cutting intervals (6 and 8 weeks) served as sub plots. Grasses harvested at both the 6th week and 8th week after planting were fed to the 8 WAD sheep in a latin square design for the digestibility trials which lasted 21 days. Feed intake and weight gain of the animals were recorded at the beginning and end of the trails. Animals on the 200 KgN/ha fertilized grasses at 8 weeks gained an average of 2.1 g/day after consuming an average of 1.3 KgDMY per day. They had a CP digestibility of about 89.1%, which was significantly different ($p<0.05$) from the control that had 79.7% CP digestibility. The animals on the control gained about 0.04 g/day after consuming an average of 0.9 KgDMY/day. Mineral content except for copper increased in significant proportion ($p<0.05$) as the nitrogen level increased in the soil. The increase in the phosphorus level might be responsible for the higher feed intake recorded for animals on the 200 KgN ha^{-1} grass plot since it increased the palatability and acceptability level. Proximate analysis of the grass revealed a crude protein value of 6.9, 9.2, 12.8 and 13.1% CP for 0, 100, 200 and 400KgN ha^{-1} respectively at 8 weeks. The 6-week cutting had 5.5, 7.5, 9.2 and 10.1% crude protein values for the different treatments, respectively.

Key words: *Panicum maximum* cv T58, feed utilization, growth performance and WAD Sheep

INTRODUCTION

The biological relationship between ruminants and forage is a very important one considering the essential role the forages play in the nutrition of ruminants[1]. The recognition of this fact has yielded well-researched method through which the productivity and nutritional quality of forages could be enhanced. Some of these methods include the nitrogen fertilization of pure grass stands and the incorporation of adapted herbaceous legumes into grass pasture lands[1,2]. Nitrogen is the most often deficient nutrient in most tropical soils and its level affects other nutrients especially phosphorus and potassium.

The composition and nutritive value of grasses are dependent upon a number of factors such as climatic conditions in which they are grown, stages of maturity and soil type. The presence of mineral element in animal feed is vital for the animal's metabolic processes. Grazing livestock from tropical countries often do not receive mineral supplementation expect for common salt and ruminant animals depend almost exclusively upon forage for their mineral requirement[3]. Mineral deficiencies in soils and forages account partly for low animal production and reproductive problems.

Panicum maximum species (part of tropical grasses) have been reported to respond well to Nitrogen fertilizer application like many other tropical grasses[3-6]. The grass has also been reported to be a good feed source which when improved was able to meet the minimum nutritional requirement of the West African Dwarf Sheep[4,7].

Cynodon nlemfuensis[8] in Ibadan and reported increased crude protein as nitrogen level increased up to 164 KgN ha^{-1}/year. At 200 KgN ha^{-1}[3] reported a crude protein content of 11.8% for *Panicum maximum* cv Ntchisi.

Panicum maximum cv T58 being a new species introduced from Cote-d'Ivore was therefore studied in the derived savanna zone to evaluate its yield and nutritive value under nitrogen fertilization improvement technique.

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Table 1: Dry matter yield (Kg ha^{-1}). Proximate and mineral analysis of *Panicum maximum* cv T58 at 6 weeks

Parameters Measured	Treatments 0	100	200	400	SEM
DMY	1886.5^c	2485.2^b	4212.6^a	4815.3^a	10.2
DM%	48.2^c	54.6^b	66.5^a	65.5^a	1.2
CP%	5.5^c	7.5^b	9.2^a	10.1^a	1.2
Ash%	11.6^a	11.3^a	10.4^b	10.6^b	0.2
EE%	1.3^b	1.6^b	2.1^a	1.8^b	0.1
CF%	30.6^a	28.9^b	25.1^b	26.1^b	1.1
NFE%	51.0^a	50.7^a	51.2^a	50.0^a	0.2
P%	0.6^a	0.7^a	0.9^a	0.8^a	0.1
Mn mg kg^{-1}	38.2^a	39.4^a	40.1^a	40.2^a	0.2
Cu mg kg^{-1}	3.1^a	2.8^b	2.5^b	2.3^b	0.2
Zn mg kg^{-1}	39.1^b	41.2^b	43.1^a	40.5^b	0.2
Fe mg kg^{-1}	96.4^b	97.2^b	101.4^a	98.6^b	1.2

a,b, c, d, e means in the same row as significantly different ($p<0.05$)

MATERIALS AND METHODS

Site: The experimental plot was sited at the Teaching and Research Farm of Ladoke Akintola University of Technology, Ogbomoso, located in the derived savanna zone of Nigeria. Ogbomoso lies at approximately $8^0 7''$North of the equator and $4^0 15''$ East of Greenwich meridian. It lies within the derived savanna region of country. The climate is characterized by a fairly high uniform temperature (26.20°C), moderate to heavy seasonal rainfall (1247 mm annually) and high relative humidity. The natural vegetation is considered to be low land rain forest but under the influence of high agricultural activities comprising a bush fallow system of farming little high forest remains. Therefore, it is regarded as a derived savanna vegetation zone because grassy vegetation has followed the clearing of land and cultivation.

Forage establishment and design: Grass stands were established on a 32 m by 47 m plot. The grasses were vegetatively propagated in a split plot design. The fertilizer regimes (0, 100, 200 and 400 KgN ha^{-1}) were the main plots while the sub plots were the 6th and 8th weeks cutting. Each treatments was replicated thrice in a randomized complete block design. Dry matter yield was evaluated at the end of the 6th and 8th weeks of planting.

Feeding trial: 8 West African Dwarf Sheep (dewormed and deloused and given recommended drugs) were used for the feeding trial in a Latin Square design. It lasted 28 days but the digestibility studies lasted 21 days. Feed was offered according to body weight (Kg) every morning and water offered ad-libitum. An adjustment period of 7 days was given. Feed intake, Left over, Volume of Urine, Volume of water, offered weight changes and digestibility were recorded as parameters measured. Feed and Feacal samples were collected for chemical analysis.

Chemical analysis: Feed, Feacal, Urine samples were collected for Proximate and Nitrogen analysis using the Kjedahl method[9]. Mineral analysis was also done using the Brayl 1 method.

Statistical analysis: All data collected were analyzed using ANOVA[10] and means compared using the same software.

RESULTS AND DISCUSSION

The results of the experiment show that the 400 KgN ha^{-1} had the highest mean dry matter value (4815.3 Kg ha^{-1} and 5855.21 Kg ha^{-1}) for the 6th and 8th weeks harvesting. However, the proximate analysis revealed a non significant difference ($p<0.05$) in the nutrient values of the grasses fertilized with 200 KgN ha^{-1} and the 400 KgN ha^{-1} and cut at the 6th and 8th weeks respectively. The dry matter increased due to the increase in tissue deposition[11]. The crude protein values ranged between 9.2 to 12.8% for the 200 KgN ha^{-1} grass harvested at between the 6th and 8th weeks Table 1. The optimum level of crude protein was recorded at the 200 KgN ha^{-1} and at the 8th weeks. *Panicum maximum* responds optimally to fertilizer treatment at the 200 KgN ha^{-1} application[4,5,12]. Mean crude protein values of 7.4% for green panic and Ntchisi at 6th weeks had been reported[7,13]. The higher crude protein value recorded for this cultivar could be due to cultivar differences and soil composition. The seasonal effect may also be responsible for the higher dry matter

Table 2: Dry matter yield (Kg ha^{-1}) proximate and mineral analysis of *Panicum maximum* cv T58 at 8th weeks

Parameters Measured	Treatments 0	100	200	400	SEM
DMY	2865.5^c	3585.2^b	5255.5^a	5455.2^a	21.6
DM%	64.5^c	74.8^b	84.2^a	85.5^a	1.1
Ash%	13.9^a	13.6^a	12.7^b	12.9^b	0.1
EE%	1.7^b	1.9^b	2.8^a	2.1^b	0.1
CF%	37.3^a	34.9^b	30.1^c	31.1^c	0.2
NFE%	39.4^a	40.4^a	41.6^a	40.8^a	0.2
P%	0.13^c	0.10^a	0.15^a	0.12^a	0.1
Mn mg kg^{-1}	41.5^a	42.3^a	44.5^a	43.5^a	0.2
Cu mg kg^{-1}	2.9^a	2.6^b	2.1^c	1.8^c	0.1
Zn mg kg^{-1}	42.1^c	45.1^b	48.1^a	46.1^b	0.2
Fe mg kg^{-1}	100.5^b	101.2^b	108.5^a	101.2^b	1.2

a,b, c, d, e means in the same row as significantly different ($p<0.05$)

Table 3: Feed intake (Kg/day), weight gain (g), nitrogen retention (g) and digestibility (%) of west african dwarf sheep fed grasses cut at 8 weeks

Parameters Measured	Treatments 0	100	200	400	SEM
Average	12.3	12.4	12.3	12.4	
Final Average weight (Kg)	13.2	13.5	13.6	13.4	
Feed Intake (g/day)	0.9^b	1.0^b	1.3^a	1.0^b	0.1
Digestibility					
DM%	73.8^c	79.9^c	90.6^a	84.5^b	0.2
CP%	79.7^b	75.1^b	89.1^a	77.4^b	0.2
CF%	79.2^a	74.0^b	74.0^b	74.5^b	0.1
Ash %	83.5^b	84.9^a	86.4^a	85.5^a	0.2
Nitrogen retention					
N-Intake (g)	250.1^c	271.0^b	292.4^a	270.5^b	1.2
N-Output (g)	47.0^c	64.3^b	80.0^a	61.2^b	0.2
N-Retention (g)	203.1^b	206.7^b	212.4^a	209.3^b	1.1

a,b, c, d, e means in the same row as significantly different ($p<0.05$)

yield with higher chemical composition because the grass was treated in the early rainy (may) period but harvesting was done at the between July and August. The effect of rain could have also been responsible for the differences observed.

The Crude Fibre, (CF) ranged between 25.1% and 30.1% at between the 6th and 8th week of planting Table 1. These values are to opposed to the 35.2-36.5% CF range reported (1977). Previous value reported[14] was within the range (27.8% CF) at 8 weeks. The difference in these reports could be due to the climatic and seasonal variations. The ether extract reported in this study falls within the 1.2-2.9% reported range[14,15]. The ether extract value ranged between 1.3-2.8%. The value was lower than the 3.0% EE earlier reported[13]. The Ash content was high and not comparable to the reported 6.24% Ash for local panic[16]. The difference observation in those results might be due to the state of the soil at the time of planting and nature of the parent material in this zone. This is because preliminary soil analysis showed that the soil was high in mineral content.

Animals fed the grass at 6 weeks gained about 1.0 Kg while at 8 weeks the weight gain increased to about 1.3 Kg. This suggests that the dry matter intake at 8 weeks after planting was more and is evidenced in Table 2. The higher intake at the 8th week compared to the 6th week harvest could be due to the higher phosphorus concentration in the grass as more nitrogen is being deposited. As earlier reported[17-19], nitrogen is very important in cell maturation and growth and phosphorus increases as the Nitrogen level increases. The higher nitrogen deposition could be evidenced in the higher crude protein value recorded at the 8th week. The intake was higher because phosphorus had been reported[20,21] to be responsible for the degree or level of palatability and eventually the growth rate.

Higher growth rate was evidenced in the animals fed the 200 KgN ha^{-1} fertilized grasses. This agrees with previous report[22], that higher intake level has a direct link with growth rate when the feed sample is efficiently utilized. Therefore, the highest dry matter digestibility recorded for these animals was expected. The grass at 8 weeks of planting had a Dry Matter Digestibility (DMD) of 90.6% with a Crude Protein (CP) and Ash Digestibility's (AD) of 89.1 and 86.4%, respectively Table 3. These values were higher than the values obtained at the 6th week as 71.4% DMD, 69.2% CPD and 53.6% AD Table 4. This suggests that most tropical grasses at about 8 weeks of age are highly digestible and has an optimum utility after which there is a decline in the

Table 4: Feed intake (Kg/day) weight gain (Kg), digestibility (%) and nitrogen retention (g) of west african dwarf sheep fed grasses cut at 6 weeks

Parameters Measured	Treatments 0	100	200	400	SEM
Average initial weight (Kg)	12.3	12.4	12.3	12.4	
Final Average weight (Kg)	12.8	13.0	13.3	13.3	
Feed Intake (Kg/day)	0.9^{b}	0.9^{b}	1.1^{a}	1.2a	0.1
Digestibility					
Dm%	54.8^{c}	57.6^{c}	71.4^{a}	65.6^{b}	0.2
CP%	59.2^{b}	58.2^{b}	69.1^{a}	57.4^{b}	0.2
CF%	58.1^{b}	54.8^{c}	64.2^{a}	61.7^{a}	0.1
Ash %	53.4^{a}	54.1^{a}	53.6^{a}	54.5^{a}	0.2
EE%	55.8^{b}	56.9^{b}	57.5^{a}	58.2^{a}	0.1
NFE%	54.8^{d}	57.6^{c}	71.4^{a}	65.6^{b}	0.2
Nitrogen retention					
N-Intake (g/day)	201.1^{d}	212.0^{c}	238.4^{a}	220.1^{a}	1.2
N-Output (g/day)	37.8^{d}	45.3^{c}	67.7^{a}	49.7^{a}	0.1
N-Retained (g)	163.3^{c}	166.7^{a}	170.7^{a}	170.4^{a}	1.0

a,b, c, d, e means in the same row as significantly different ($p<0.05$)

level of utilization[16,23]. The Nitrogen retention was also highest at this level of application and lowest at the 0 KgN ha^{-1} plot. There was no significant difference ($p<0.05$) however in the amount of Nitrogen retained at the 100 KgN ha^{-1} and 400 KgN ha^{-1} grass plots. Animal growth performance and feed intake also followed the trend as for the former.

Animals with the highest dry matter digestibility were able also to break down the fibre content properly because the rumen microbes had adequate protein that could enhance their own metabolic activity and which thus led to higher herbage breakdown. This is in line with the report[16] on dry matter digestibility in the rumen.

On grass micro mineral content and nitrogen availability on the Nitrogen retention, animals on the 200 KgN ha^{-1} and 400 KgN ha^{-1} grasses had the highest nitrogen retention value (170.1 g) while the lowest was for those on the control (163.3g). There was no significant differences ($p<0.05$) in the 0 and 100 KgN ha^{-1} retention values and also for the 200 KgN ha^{-1} and 400 KgN ha^{-1}, espectively. This trend was revealed in the weight gains of the animals also. But cost implication makes 200 KgN ha^{-1} to be preferred to the 400 KgN ha^{-1}. This is because there was no significant difference in animal performance even at double the fertilizer level for the 400 KgN ha^{-1}.

Furthermore, of important note is the decrease in the copper level of the grass as the Nitrogen level increased. Higher Nitrogen level causes reduction in the copper concentration level[24,25]. The grass samples were able to meet the West African Dwarf Sheep minimum nutritional requirement[26]. Manganese, Zinc and Iron levels increased as the Nitrogen level increased[27-30].

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