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September 27, 2006Feed Utilization and Growth Performance of Wad Sheep Fed Space Imposed and Nitrogen Fertilized *Panicum maximum* CV T58 in the Derived Savanna Zone

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Abstract: *Panicum maximum* cv T58 was established on a three Nitrogen (0, 100 and 200 KgN ha^{-1}) and spacing (50×50, 75× 75 and 100×100 cm) regimes in factorial arrangement using randomized complete block and split plot designs. The three nitrogen levels were the main treatments while the spacing was the sub treatments each replicated three times. Dry matter evaluation was done and nutrient quality analyzed after 8 weeks of planting. The harvested grass was fed to twenty-seven West African Dwarf Sheep in nine treatments with three replicates each. Feed intake, weight gain, feed digestibility, feed utilization and feed to gain ratio were parameters measured. From the results, animals on the 200 KgN ha^{-1}/50×50 cm plot with a crude protein of 11.8% had the highest feed intake, weight gain and utilization values. The lowest were recorded for the 0KgN ha^{-1} treatment (5.2% CP). The 100 KgN ha^{-1}/50×50 cm (10.8% CP) and 100 KgN ha^{-1}/75×75 cm (8.6% CP) were not significantly different ($p<0.05$) in performance when compared to the 200 KgN ha^{-1}/50×50 cm spacing (11..8% CP) and 200 KgN ha^{-1}/75×75 cm spacing (9.6% CP), respectively. The phosphorus level followed the trend for the nitrogen level in all grass samples, which affected the acceptability level. Therefore, *Panicum maximum* cv T58 can be established on a 200 KgN ha^{-1}/50×50 cm or 100 KgN ha^{-1}/50×50 cm or on the 75×75 cm spacing and feed at 8 weeks for optimum animal production in the derived savanna zone.

Key words: *Panicum maximum* cv T58, spacing, nitrogen fertilizer, growth performance, WAD sheep

INTRODUCTION

Pasture has great potential for increasing animal productivity. In Nigeria and many other countries in the tropics, low yielding poor quality and inefficient utilization of natural pasture are some of the factors limiting the level of livestock production[1]. The yield and quality of tropical grasses vary seasonally with minimum value during the dry and peak during the rainy season. Ruminant animal rely more profitability on pastures for their nutrition than on any other feed resources. The carrying capacity which influences animal production depends largely on the dry matter yield and feeding value of forages on pasture fields[2]. In humid tropics of high temperature and moisture, grasses mature rapidly with high lignin content. Thus, tropical grasses are generally lower in nutritive value than temperate grasses of comparative age[3]. These low nutritive values can be improved through fertilizer application to provide well-balanced feed for livestock. When minerals are deficient in pastures, loss of appetite, low productivity and poor health occurs in animals[4]. Knowledge of nutrient composition of an available feed ingredient, coupled with knowledge of the basic nutrient requirement is necessary. This would help to formulate and prepare balanced ration that is suitable for different classes of livestock.

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[5]. Mineral deficiencies in

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soils and forages account partly for low animal production and reproductive problems.

Panicum maximum (guinea grass) a tropical and sub-tropical pasture grows over a wide range of ecological zone in Nigeria[6] and had being used in ruminant feeding. It has been reported to increase dry matter yield and crude protein content as a result of increased nitrogen level in the soil[7].

This tropical grass has been used as a reliable feed resource for ruminant feeding in the tropics. This grass has been subjected to different stress conditions, soil manipulations like spacing and intercrop with forages especially herbaceous legumes. Spacing had been reported to influence the dry matter productivity and quality of tropical forages[8] while an increase in dry matter yield with higher degradability at the lowest spacing of *Canavalia ensiformis* was reported[9]. Therefore, this experiment was conducted to evaluate the feed utilization and growth performance of WAD Sheep fed guinea grass (*Panicum maximum* cv T58, a new cultivar from Cote d'ivore), grown at different spacing in the derived savannah zone.

MATERIALS AND METHODS

Location of experiment: The experiment was conducted at the Teaching and Research Farm of Ladoke Akintola University of Technology, Ogbomoso in the derived Savannah 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 (36.20°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. The grass studied i.e., *Panicum maximum* had its native species like green panic and Ntchisi but cultivar T58 was newly introduced from Coted'ivore.

Experimental designs and layout: The agronomic experiment was in a 3×3 factorial arrangement using randomized complete block design on a split plot. The fertilizer regimes (0, 100 and 200 KgN ha^{-1}) were the main plots and factor 1 while the second factor spacing (50×50, 75×75 and 100×100 cm) were three sub plots. The experimental plot was on a 32×47 m land. There were replicates each. The Agronomic phase lasted 8 weeks. The feeding experiment was in a complete randomized design with 27 WAD sheep replicated three times. It lasted 56 days with an adjustment of 14 days.

Parameters measured: The dry matter yield of the grass, feed intake of animal feed utilization, weight gain feed to gain ratio and digestibility were measured.

Chemical analysis: Feed and feacal samples were analyzed using the AOAC method[9].

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

RESULTS AND DISCUSSION

The results of this study confirmed previous remarks[11-15] that *Panicum maximum* is responsive to nitrogen fertilization. Moreover, as reported [8,16], the grass has also been confirmed to be influenced in quality and quantity by the planting space Table 1.

The highest dry matter yield (6822.1 Kg/ha/DM) was recorded for the 200 KgN ha^{-1} plot spaced at 50 by 50 cm. However, no significant difference ($p<0.05$) was observed for the grasses on this same spacing but received 100 KgN ha^{-1} in terms of yield and nutritive value (6690.2 Kg/haDMY). Grasses on the 200 Kg/ha fertilizer plot were different in their performance. Through the best performance in terms of yield and quality was for the 50×50 cm, the other plots 75×75 cm and 100×100 cm plots also performed very well when compared to other treatments. The 75×75 cm plot was not significantly different ($p<0.05$) from the 50×50 cm but the 100×100 cm in quality was different. Those grasses on the 0 kg/N/ha plots (Control plots) helped in affirming the usefulness of the nitrogen fertilizer and the level of response of this new cultivar of *Panicum maximum* in the derived savanna zone. This agrees with previous works[15,17] on Ntchisi in this zone.

The grasses on the 50×50 cm performed very well in terms of yield and quality for the three fertilizer regimes. However, little difference of no significance ($p<0.05$) occurred between these plots and the 75×75 cm. The 100×100 cm plots experienced a lower dry matter yield even at this wider spacing. The reason for this poor performance could be due to the loss of nutrient through leaching, poor ground cover, atmospheric loss and poor organic matter deposition and decomposition into the soil. This is in agreement with previous report[18,19] that wider spacing leads to loss of soil nutrient beyond root zone.

Table 1: Dry matter yield (Kg ha^{-1}) and Chemical Composition (%) of *Panicum maximum* cv T58 under three fertilizer and spacing regimes at 8 weeks

Parameters measured	Treatments 0/50	0/75	0/0.1	100/50	100/75	100/001	200/50	200/75	200/001	SEM
DMYKG/ha	4473.7^{d}	3856.2^{d}	2760.2^{e}	6690.2^{a}	5757.5e	3166.4^{e}	6822.9^{a}	6061.1^{b}	4063.2^{d}	13.1
Dm%	75.5^{d}	73.5^{d}	69.7^{d}	85.2^{a}	84.3^{b}	80.8^{c}	88.2^{a}	86.4^{a}	82.2^{c}	0.1
CP%	7.6^{d}	6.7^{e}	5.2^{e}	10.8^{a}	8.6^{c}	6.2^{e}	11.8^{a}	9.6^{b}	7.2^{d}	0.2
CF%	37.3^{b}	39.5^{b}	42.5^{a}	37.4^{b}	39.6^{b}	40.7^{a}	34.8^{c}	33.6^{c}	36.5^{c}	0.1
Ash%	12.9^{b}	12.7^{b}	11.9^{c}	13.5^{a}	13.1^{a}	12.1^{b}	13.1^{a}	13.0^{a}	12.1^{b}	0.1
EE%	2.1^{b}	1.9^{c}	1.7^{c}	3.3^{a}	2.5^{b}	1.6^{c}	3.1^{a}	2.2^{b}	1.9^{c}	0.2
NFE%	40.1^{a}	39.2^{b}	38.7^{b}	35.0^{c}	36.2^{e}	39.4^{b}	37.2^{b}	41.6^{a}	41.7^{a}	0.1
P%	0.09^{d}	0.08^{d}	0.09^{d}	0.13^{b}	0.12^{c}	0.09^{d}	0.15^{a}	0.13^{b}	0.11^{c}	0.1

a,b, c, d, e means in the same row as significantly different ($p<0.05$). 0/50- 0 KgN ha^{-1}/50×50 cm, 0/75- 0 KgN ha^{-1}/75×75 cm, 0/0.1- 0 KgN ha^{-1}/100×100 cm, 100/50- 100 KgN ha^{-1}/50×50 cm, 100/75- 100 KgN ha^{-1}/75×75 cm, 100/0.1- 100 KgN ha^{-1}/100×100 cm, 200/50- 200 KgN ha^{-1}/50×50 cm, 200/75- 200 KgN ha^{-1}/75×75 cm, 200/0.1- 200 KgN ha^{-1}/100×100 cm

Table 2: Feed intake and growth performance of WAD sheep fed treated *Panicum maximum* cv T58

Parameters	Treatments 0			100			200			
measured	50	75	0.1	50	75	0.1	50	75	0.01	SEM
Number of Animal	3	3	3	3	3	3	3	3	3	
Duration of Feeding	56	56	56	56	56	56	56	56	56	
Avg. Initial weight (Kg)	9.05	8.05	8.05	7.00	8.55	7.55	7.25	7.06	6.00	
Avg. Final weight (Kg)	9.13	8.12	8.11	7.09	8.13	7.65	7.36	7.16	6.09	
Avg. weight gain (Kg)	0.08	0.07	0.06	0.09	0.08	0.10	0.11	0.10	0.09	
Avg. Feed intake (Kg)	0.52^{b}	0.27^{d}	0.47^{c}	0.60^{b}	0.41^{c}	0.48	0.81^{a}	0.48^{c}	0.56^{b}	0.1
Weight of feaces (Kg)	9.05^{a}	8.05^{b}	8.05b	7.00^{c}	8.55^{b}	7.55	7.25^{c}	7.06^{c}	6.00^{d}	0.1
Amount digested	0.48^{c}	0.25^{e}	0.42c	0.57^{b}	0.36^{d}	0.36	0.72^{a}	0.40^{c}	0.42^{c}	0.1
Efficiency of feed Conversion/Feed utilization	3.2^{c}	2.1^{d}	3.2^{c}	3.8^{b}	2.4^{d}	2.1	4.0^{a}	2.4^{d}	2.1^{d}	0.1
% Dry matter digested	92.7^{a}	92.6^{a}	89.4^{b}	92.5^{d}	87.8^{b}	87.8	88.9^{b}	83.30^{c}	75.0^{d}	0.2
FCR/feed to gain ratio	0.3^{a}	0.8^{a}	0.3^{d}	0.2^{e}	0.4^{c}	0.5	0.3^{d}	0.4^{c}	0.5^{b}	0.1

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

The nutrient composition analysis revealed a crude protein levels of 7.6, 10.%, 11.8% for grasses on the 50×50 cm spacing and receiving 0, 100 and 200 KgN ha^{-1}, respectively. This is within the range of crude protein (7-10.5%) reported[20] for spacing at 50×75 cm and receiving the same nitrogen levels. The 75×75 cm spacings for the three treatments ranged between 6.6 and 8.6% while the 100 by 100 cm spacing at the three levels had 5.2, 6.2 and 7.8%, respectively. The crude fibre content ranged between 33.6 and 42.5% with the 0 KgN ha^{-1}/100×100 cm plot having the highest crude fibre level. The lowest was for the 200 KgN ha^{-1}/75×75 cm spacing. This result confirms previous reports that as the nitrogen intake level decreases and forages increase in age, the crude fibre level of grasses increases while the crude protein level decreases[21-24]. There was increase in age but the amount of nitrogen available for grass root uptake decreased at the 0 KgN ha^{-1} and highest at the 100×100 cm plot. Aromatic organic compounds have been reported to be possibly oxidized[25,26] to form reactive free radicals that can polymerize and trap nitrogen-containing compounds during organic matter decomposition if the soil surface is exposed Table 2.

The feed utilization evidenced in the growth performance or weight gain revealed the best performance for the animals on the 200 KgN ha^{-1} when compared to the 0 and 100 KgN ha^{-1} treatments. The highest feed utilization (4.0) was recorded for the animals on the 200 KgN ha^{-1}/50×50 cm. Animals readily consumed and were able to convert the feed to muscle as evidenced in their weight gain (0.11 Kg). The amount of dry matter ingested by the animals on the 0 KgN ha^{-1} was highest (about 92.5%) but the rate of utilization was poor. This is evidenced in the weight gain of the animals (0.07 kg) after 56 days of feeding. The animals gained the least with an average of 0.07 Kg after 56days of feeding. Phosphorus level was highest at the 200 KgN ha^{-1}/50×50 cm plot and lowest at the 0 KgN ha^{-1} plots. Lower phosphorus level in less nitrogen concentrated soils have been reported[27].

Nitrogen level had a direct linkage with rate of live weight change as reported[1]. The higher the nitrogen intake in terms of crude protein, the higher the weight gain because proteins are responsible for muscle build-up. It also has a correlation with the health of the animal. Wornout tissues which degenerate only in ill health conditions can be regenerated by the help of proteins. Therefore, for an animal to be able to optimal productivity, the protein intake should not be low. An animal that also feeds very well will not easily come down with sickness because the body is immuned naturally through the consumption of good, adequate and nutritionally balanced ration. Therefore, animals on the 200 KgN ha^{-1} had the best performance because of factors as these.

The effect of the higher nitrogen content was evidenced in the feed to gain ratio. The animals on the 200 KgN ha^{-1} fertilizer regimes did not have to eat a volume before proper efficiency of feed was achieved. The effect was also noticed in the crude fibre level. Though it was high when compared to the crude protein levels and decreasing along treatment. Overall comparism shows that Nitrogen has the ability to reduce crude fibre deposition at a younger age i.e in a developing tiller. The percentage dry matter digested for these group of animals shows that the higher nitrogen concentration led to higher microbial activity in the digestion process.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 the report on dry matter digestibility in the rumen.

This experiment therefore concludes by stating that application of 100 KgN ha^{-1} or 200 KgN ha^{-1} at 50×50 cm or 25×75 cm would be able to provide enough dry matter for animal consumption from the cost implication, application of 100 KgN ha^{-1} at 50×50 cm will be able to meet animals minimum nutrient requirement according to[28].

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