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EFFECT OF VARYING RATIOS OF *Panicum maximum*: *Centrosema pascorum*MIXTURES ON VOLUNTARY FEED INTAKE, NUTRIENT DIGESTIBILITY AND NITROGEN BALANCE IN RED SOKOTO BUCKS

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ABSTRACT

The feeding value of mixtures of *Panicum maximum* and *Centrosema pascorum* were investigated with Red Sokoto bucks, by feeding with *Panicum: Centro* hay at different mixtures of 80:20, 70:30, 60:40 and 50:50, respectively. Four mature bucks with average body weight of 13.12kg were used in a 4 X 4 Latin square design, during which feed intake, digestibility and nitrogen utilization were monitored. Significant (P<0.05) difference in the basal diet intake was observed, with animals fed 50:50 diet having the higher value (166.88g/day). There was no significant difference (P>0.05) in the daily feed intake of animalfed 70:30 and 80:20 mixture diets. Similar trend was also observed in total feed intake and dry matter intake. Animal fed 50:50 diet had significant highest (P<0.05) crude protein (CP) digestibility (61.85%) while those fed 80:20 diet recorded the least (54.39%). The crude fibre (CF) digestibility increased significantly (P<0.05) from 57.67% in 80:20 diet to 65.72% in 50:50 diet. Nitrogen intake was significantly (P<0.05) affected by dietary treatment, with :80:20 diet having theleast N intake (7.12 g/day).which increased with increase in the level of Centro with animals fed 50:50 diet having the highest value (9.76 g/day). Both nitrogen absorbed and nitrogen retained as percent of intake for 50:50 diet were significantly (P<0.05) higher as compared to all other treatments, with 80:20 diet recording the least values. It can be concluded that feeding 50:50 and 60:40 *P. maximum* to *Centrosema pascorum* mixture produced the best result in terms of nutrient intake, digestibility and nitrogen balance in Red Sokoto bucks.

Keywords: Bucks, centrosema, feed intake, nutrient digestibility, Panicum

INTRODUCTION

Livestock play a very important role in Nigerian agriculture, contributing about 12.7% of the agricultural GDP (CBN, 1990). The population of livestock in Nigeria comprises of about 14 million cattle, 34 million bucks and 22 million sheep and about 100 million poultry (FDLPCS, 1992).In most of sub-Saharan Africa countries, ruminant livestock production is based on feeding of herbaceous materials including grasses, legumes, browse trees and fibrous crop residues. The main limitations to animal production are lack of green feed for at least half of the year coupled with low nutritive quality of forages during most of the period of active pasture growth (Jones and Wilson, 1987).

The low nutritive quality of the forage during the growth period is mainly due to environmental stresses such as high temperatures (Van Soest, 1988) and infertile soils (Roberts, 1987). There have been several attempts to improve the nutritive quality of the forage resource base through propagation of species with high nutritive value (Dzowela, 1988). However, because of limited land, the quantities of such forages produced are not sufficient on their own to support the current livestock population. The denuded grasslands, forest openings and the forests are major sources of herbage for livestock feeding (Sumberg,

2002). Tchinda *et al*. (1993) reported that native pastures are the most widely available low cost feeds for ruminants in the tropics. The native pastures deteriorate rapidly especially in the dry season. Guinea grass (*Panicum maximum* Jacq.) is a tropical African grass often used to feed beef cattle (Toledo-Silva *et al*., 2013).

One of the ways of increasing livestock production in Nigeria is to increase the area and quality of legume - based pastures. Centrosema (centro) is a vigorous, trailing, twining and climbing perennial herb with trifoliate leaves and is fairly drought tolerant (Skerman *et al*., 1988).

Centrosema pubescens is very rich in protein (19.6%) and minerals (Nworgu *et al*., 2001). Muhammad *et al*. (2002) recommended that *Centrosema spp.* be integrated into the crop - livestock farming system of the low land areas of Northern Nigeria. Ndlovu (2000) reported judicious combinations of these feeds with the more abundant low quality forages are needed. This study evaluated the various combinations of *Panicum maximum* and *Centro* species as basal diet fed to bucks.

MATERIALS AND METHODS

Experimental site

The study was conducted at the Small ruminant Unit of the Department of Animal Science Teaching and Research Farm, Ahmadu Bello University, Samaru Zaria, Nigeria. Zaria is located in the Northern Guinea Savannah with latitude $11^{o}12'$N and longitude $7^{o}37'$E at an altitude of about 640m above the sea level. The climate is relatively dry with an average annual rainfall of 1100mm.The maximum temperature varies from 26-35^{o}C depending on the season (Meterological Service Unit, I.A.R (2015).

Sources and Processing of Experimental Feeds

Panicum and Centrosema species regrowth were used. The materials were harvested at the end of the raining season from one of the pasture plots in NAPRI, Shika, Zaria. The harvested forages were dried and were later ground using hammer mill and stored in bags until when required for the study. The ingredients for the concentrate diet were purchased from commercial feed miller in Samaru, Zaria.

Experimental Animals and design

Four (4) Red Sokoto bucks with an average weight of 12.6 kg were used in the experiment. The experimental animals were de-wormed and sprayed against internal and external parasites with 1 ml/10 kg BW of *Albendazole*® and 0.5 ml/10 kg BW of Ivermectin (*Ivomec*®) injection, respectively before the commencement of the experiment. The animals were randomly assigned to a 4 x 4 Latin square in a complete randomize design, with 21-day in each periods. The dietary treatments were mixture of *Panicum maximum* and *Centrosema species* in a mixture 50:50, 60:40, 70:30 and 80:20 each serve as dietary treatment. In addition the animals were fed 1.5% of their body weight of concentrate diet containing Cotton Seed Cake, Maize offals, Rice bran, Salt and Bone meal, formulated to contain 14% CP (Table 1). The mixtures of Panicum and Centrosema species were fed *ad libitum*. All animals were provided with clean water *ad libitum*. The experimental animals were housed in an individual metabolism crate with separate urine and faecal collection pan at the bottom as described by Osuji *et al.* (1993).

Effect of varying ratios of panicum maximum: centrosema pascorummixtures

Collection of faecal and urine samples

Daily total faeces in each period was collect and 30g was sub sampled and oven dried at $105^{O}C$ for 48hours and weighed to determine the dry matter content of the faeces, after then the faeces were bulked and 5% sub sample was taken for analysis. Daily collection of urine and faeces were made in the last 5 days of each period. Total urine voided by individual animal was collected in a container with 20ml H_2SO_4 to preserve nitrogen in the urine. Urine samples of 20ml were taken and stored at $-20^{O}C$ in the laboratory until when required for analysis of urinary N.

Nutrient Digestibility was calculated as follows:

$$Nutrient\ digestibility = \frac{nutrient\ intake - nutrient\ in\ feces}{nutrient\ intake} X\ 100$$

Laboratory analysis

Samples of *Panicum maximum*, *Centrosema pascourum*, Concentrate diet and treatment diets (mixtures of Panicum and Centrosema) and faeces were analyzed for dry matter, crude protein and crude fibre and also Urine samples were analysed for Nitrogen using Macro-Kjeldah technique contents using the (AOAC, 2005) procedure.

Statistical analysis

All data on nutrient intake, nutrient digestibility and nitrogen balance from the experiment were subjected to Analysis of Variance (SAS, (2001) and where significant differences were observed, treatment means were statistically compared by Duncan's Multiple Range Test of the SAS package. The following model was used

$$Y_{ijk} = M + A_i + B_j + C_k + e_{ijkl}$$

where:

Y_{ijk} = Independent variable (Intake, apparent digestibility, etc)
M = Overall mean
A_i = Effect of period (1, 2, 3, 4)
B_j = Effect of bucks (A, B, C. D)
C_k = Effect of treatment diets (Panicum: Centro mixtures)
e_{ijkl} = Effect of random error

RESULTS AND DISCUSSION

Experimental feeds

Tables 1 and 2 showed the results of the proximate composition of the feed materials used in this study. The crude protein (CP) of *Centrosema pascorum* in this study (13.24%) was lower than the value (18.29%) reported byAjayi and Babayemi (2008). The CP of *Panicum maximum* was higher than the values of 7.02 and 8%, respectively reported in previous studiesby (Bamikole *et al*., 2003;Arigbede *et al*., 2005), but lower than the value of 12.5% reported by Ajayi and Babayemi (2008). The variation in the crude protein level could be attributed to the stage of harvest and the level of fertilization of the Panicum and also the soil upon which it was grown.

The crude protein of *P. maximum* and Centrosema mixture decreased with increase in the *P. maximum* in the diet. The 80:20 having lower 9.32% CP, while 50:50 had the highest (13.72%). This increase was as a result of the high crude protein content of the *Centrosema pubescens* hay over the *P. maximum* hay being a grass, which is generally low in crude protein when harvested as hay (Table 1).

Table 1: Proximate composition of the experimental feed ingredients

Parameters (%)	*P. maximum*	*C. pubescens*	Concentrate diet
Dry matter	94.56	96.72	95.13
Organic matter	87.17	87.58	92.07
Crude protein	7.31	13.24	14.37
Crude fibre	23.18	18.8	17.56
Ether extract	2.18	3.32	21.15
Ash	7.39	9.14	3.06
Nitrogen free extract	59.94	55.5	43.86

Table 2. Proximate composition of four basal diets of Panicum andCentrosemamixtures

Parameters (%)	Panicum: Centro mixture			
	80:20	70:30	60:40	50:50
Dry matter	97.89	97.19	94.58	96.22
Organic matter	90.59	89.28	89.13	88.73
Crude protein	9.32	11.64	12.32	13.72
Crude fiber	35.48	34.20	33.21	32.78

Feed Intake

Results in Table 3 shows the feed intake by bucks fed Panicum: Centrosema mixtures basal diet. There was significant ($P<0.05$) difference in basal diet intake, with 50:50 diet having significantly higher intake (162.88 g/day) than 60:40 diet (151.25 g/day) which was statistically higher than 70:30 diet (143.75 g/day); though, there was no statistical ($P>0.05$) difference between the intake of 70:30 and 80:20 diets Similar trend was also observed in total intake and dry matter intake with 50:50 having statistically ($P<0.05$) higher values when compared to all the other treatments. Organic matter (OM) intake for 50:50 diet (267.54 g/day) was significantly higher ($P<0.05$) than 60:40 (254.28 g/day), 70:30 (254.88 g/day) and 80:20 (247.71 g/day) diets. The OM intake for 60:40 and 80:20 was statistically similar and higher than that of 70:30 which recorded the least value. The crude protein (CP) intake increased significantly ($P<0.05$) across the treatments as more Centrosema replaced Panicum in the basal diet with 50:50 (7.91 g/day) recording the highest value and 80:20 (6.48 g/day) the least. The crude fibre (CF) intake also decreased statistically ($P<0.05$) across treatments from 50:50 (74.19 g/day) to 70:30 (61.54 g/day); though, CF intake for 70:30 had the least value but statistically similar to 80:20 (60.90 g/day).

Table 3. Feed intake in bucks fed Panicum:Centrosemamixtures basal diet

Parameters (g/day)	Panicum :Centro mixture				SEM
	80:20	70:30	60:40	50:50	
Conc intake	138.8	138.8	138.8	138.8	0.00
Basal diet intake	141.75^{c}	149.69^{bc}	151.25^{b}	162.88^{a}	6.07*
Total intake	280.50^{c}	288.49^{bc}	290.050^{b}	301.65^{a}	6.07*
Dry matter intake	269.19^{c}	275.67^{b}	274.02^{bc}	289.36^{a}	5.84*
Organic matter	247.71^{c}	254.88^{b}	254.28^{b}	267.54^{a}	5.45*
Crude protein	6.58^{d}	6.97^{c}	7.54^{b}	7.91^{a}	0.09*
Crude fibre	60.90^{c}	61.54^{c}	68.39^{b}	74.19^{a}	2.03*

a,b,c:Meansinthesamerowwithdifferentsuperscriptsaresignificantlydifferent. SEM standard error of means

The result of the DM intake in this study increased with increasing levels of Centrosema in the diets. The values of DMI increased consistently with the increasing levels of Centrosema inclusion. DM intake is an important factor in the utilization of feed by ruminants and is a critical terminant of energy and performance in small ruminants (Devant *et al*., 2000). It appeared that the combination of Centrosema and Panicum was probably more palatable and more acceptable to bucks at the 50:50 mixture. Uwechue (2000) observed that the changes could be asa result of improvement in the protein status of the feed which enhances rumen micro-organism prolife mixture and so encourages a more rapid and thorough digestion of ingesta leading to stimulation.

Nutrient digestibility

The results of the nutrients digestibility are presented in Table 4. Dry matter digestibility of Panicum: Centrosema basal diet for 50:50, 60:40, 70:30 and 80:20 were 80.65, 79.92, 77.99 and 77.74%, respectively. There was no significant difference (P>0.05) in dry matter digestibility between 50:50 and 60:40 diets; though, they were both significantly higher than 70:30 and 80:20 diets which were statistically similar and lower. The digestibility of organic matter increased statistically (P<0.05) across treatments with decrease in the percent of Panicum level, with 80:20 (82.84 g/day) recording the lowest, while 50:50 (97.27 g/day) had the highest digestibility, suggesting that as more Centrosema was used to replace Panicum, organic matter digestibility increased.

The crude protein (CP) digestibility for 50:50 (61.85%) was significantly higher than 60:40 (58.16%) and 70:30 (56.14%) which were statistically similar to each other while 80:20 (54.39) recorded significantly least value, suggesting that the CP digestibility increased with increase in the percent of Centrosema up to 60:40 but further decreased statistically as more Centrosema replaced Panicum. The crude fibre (CF) digestibility decreased statistically across treatments from 65.72 g/day in animals fed 50:50 diet to 62.33 g/day in animals on 60:40 diet as more Centrosema replaced Panicum while for 70:30 and 80:20 diets, 59.18 and 58.77, respectively were similar and lower.

The result of dry matter and crude protein digestibility (Table 4) generally reported in this study are higher than 56.88 and 58.51%, respectively reported byTona 2011) for sheep fed *P. maximum*. The observation in this study is consistent with Giri *et al*. (2000) and Aregheore (2000) who affirmed that digestibility of nutrients varies with nutrient composition of the diet. The higher crude fibre digestibility observed in the 50:50 treatment diet might be related to changes in the rate of passage of ingesta from the rumen (Badamana, 1992). The result obtained

Table 4: Nutrient digestibility of bucks fed Panicum: Centrosemamixtures basal diet

Parameters (%)	Panicum: Centro mixture				SEM
	80:20	70:30	60:40	50:50	
Dry matter digestibility	77.74[b]	77.99[b]	79.92[a]	80.65[a]	0.73*
Organic matter digestibility	82.84[d]	91.18[c]	95.49[b]	97.27[a]	0.58*
Crude protein digestibility	54.39c	56.24[b]	58.16[b]	61.85[a]	1.71*
Crude fiber digestibility	57.67[c]	58.08[c]	62.33[b]	65.72[a]	1.16*

a,b,c:Meansinthesamerowwithdifferentsuperscriptsaresignificantlydifferent. DMD = Dry matter digestibility, OMD = Organic matter digestibility, CPD = Crude protein digestibility, CFD = Crude fibre digestibility, SEM standard error of means

in this study is consistentwith Ososanya *et al*. (2013) who fed corncobs and Centrosema hay to West African Dwarf sheep

Nitrogen balance

The result of the nitrogen balance presented in Table 5, shows that N intake was significantly (P<0.05) higher with increase in the mixture of Centro in the basal diet. Animals fed diet with 50:50 Panicum: Centro had higher N intake (9.76 g/day), while those fed on 80:20 mixture of Panicum to Centro diet had the lowest N intake (7.12 g/day). Nitrogen retained (balance), N absorbed and N retained as percent of intake followed similar pattern, with the animals fed the 50:50 treatment diet having significantly (P<0.05) higher results. The low N intake of 80:20 could be attributed to the lower feed intake (Table 3) hence the lower N intake.

Table 5. Nitrogen Balance of bucks fed Panicum: Centrosemamixture basal diet

Parameters (g/day)	Panicum: Centro mixtures				SEM
	80:20	70:30	60:40	50:50	
Nitrogen intake	7.12[d]	7.24[c]	8.34[b]	9.76[a]	0.10*
Urinary nitrogen	0.48[a]	0.36[c]	0.44[b]	0.54[a]	0.04*
Fecalnitrogen	4.49[b]	4.55[b]	4.54[b]	4.83[a]	0.12*
Total N outgo	4.89[b]	4.91[b]	4.98[b]	5.37[a]	0.15*
N balance	2.23[c]	2.33[c]	3.36[b]	4.39[a]	0.14*
N absorbed	2.63[c]	2.69[c]	3.80[a]	4.93[b]	0.12*
N retained as % of intake	31.32[c]	32.82[c]	40.28[b]	44.97[a]	2.12*

a,b,c:Meansinthesamerowwithdifferentsuperscriptaresignificantlydifferent. SEM standard error of means

CONCLUSION AND RECOMMENDATIONS

From the result of this study, it can be concluded that mixing Panicum with Centrosema improves its feeding value. Also the mixture of Panicum to Centrosema influenced the intake and digestibility of nutrients. Nitrogen retained increased as the level of Centrosema increased in the mixture. Therefore a mixture of 50-:50 and 60:40 Panicum to Centrosema is recommended for feeding Red Sokoto bucks in Nigeria.

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