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Effect of *Crotalaria Retusa*:Concentrate Ratio Fed to Red Sokoto Goats on Intake and Digestibility

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Target Audience: Goats farmers, Ruminant Nutritionists, Forage scientists

Abstract

An experiment was carried out to determine the effect of Crotalaria:concentrate ratio on intake, digestibility and nitrogen balance in Red Sokoto goats. Four goats with average initial weight of 15.33kg were used in a 4x4 Latin Square experiment, which lasted for 32days. The animals were allocated to 4 diets containing 20%crotalaria:80% concentrate (T_1), 40% crotalaria:60% concentrate (T_2), 60%crotalaria:40% concentrate (T_3) and 80%crotalaria:20% concentrate (T_4) diets. Feed intake was influenced ($P<0.05$) by dietary treatments, values were 2178.5, 2118.0, 1882.5 and 1476.0 for T_1, T_2, T_3 and T_4 respectively. There was no significant ($P>0.05$) difference in the final weight gain of goats fed T_3 (16.95) and T_4 (17.15). However, there was a significant difference ($P<0.05$) in final weight between goats fed T_1 (14.05), T_2 (15.15) and T_3 (16.95). Total nitrogen intake differed significantly ($P<0.05$) among treatment diets. Apparent-N-digestibility (%) value was significantly different ($p<0.05$) for goats fed T_1 diet (71.97) relative to T_4 (59.91). The result of this study shows that incorporation of crotalaria retusa leaves meal in the diet of Red Sokoto goats generally improved performance in Red Sokoto goats. However, the best level of inclusion is 40% Crotalaria:60% concentrate ratio.

Key words: *Crotalaria retusa*, Intake, Digestibility, Nitrogen balance, Red Sokoto goats.

Description of Problem

The increasing demand and subsequent cost of conventional animal feed ingredient in the tropics has created the need for sustainable alternative. The search for alternative feed resources has over the past few decade been on the use of tropical browse plant and medicinal plants as source of nutrient for ruminant and non ruminants [1]. The potentials of leaf meals from these tropical trees and shrubs to yield relatively higher level of crude protein and minerals and lower level of crude fibre than tropical grasses has also been recognize [2, 3].

Crotalaria retusa usually known as rattle box plant is a leguminous plant [4]. It belong to the genus *Crotalaria* and it is widely found in tropical Africa growing in open places from mountains to semi desert. There are over 500 species among which is *C. retusa*. The species are either annuals, perennials herb and shrubs and mostly establish during the late rains.

Crotalaria retusa is a leguminous plant that seems to have less consideration in pasture and range enterprise. Studies have shown that *Crotalaria retusa* plant thrive well on tropical African soil and can be intercropped with other crops [5, 6]. It is high in crude protein (above 13%) and depending on the part of the plant and method of processing [7]. An interesting characteristic of this rattle box plant is its ability to remain green up to the late dry season and also retain most of its leaves even when cut and preserve.

The objective of the study therefore, was to determine the effect of *Crotalaria* : Concentrate ratio on growth performance, feed intake, digestibility and nitrogen balance on Red Sokoto Goats.

Materials and Methods

The experiment was carried out at the Small Ruminant Unit of Department of Animal Science, Ahmadu Bello University, Zaria. The experimental material *Crotalaria retusa* was collected at the Institute for Agricultural Research farm, Ahmadu Bello University Zaria. The *C. retusa* was harvested in November and dried in shade for 5 days. The leaves were separated from the stalk which were packed and stored until when used.

Four Red Sokoto goats with average weight of 15.33kg were use in a 4x4 latin square design which lasted for 32 days. The goats were kept in individual metabolic crate. The experimental diets consisted of the following Crotalaria:Concentrate ratios: 20% Crotalaria:80% Concentrate, 40%Crotalaria:60%Concentrate, 60%Crotalaria:40% Concentrate and 80%Crotalaria:20%Concentrate, representing T_1, T_2, T_3 and T_4 respectively. The ingredients composition of the concentrate diet are shown in Table 1.

Table 1: Composition of concentrate diet.

Ingredients	Composition (%)
Groundnut seed cake	10.5
Maize offal	84.0
Bone meal	5.0
Salt	0.5
Total	100

The animals were housed in individual metabolism crates and allowed for 14 days adjustment period before the commencement of data collection and fed base on 3% body weight. For each treatment diet data were collected for 4 days. The feed offered, feed consume, feed rejected were recorded. Urine and feces were also collected and weighed and 10% was taken to the biochemistry laboratory for analysis. Sulphuric acid was use to trap the ammonia in the urine.

The proximate analysis for the nutrient composition, dry matter (DM), ash, crude protein (CP), crude fibre (CF), ether extract (EE), nitrogen free extract (NFE) of crotalaria, feed and faeces was done in the biochemistry laboratory, Department of Animal science Ahmadu Bello University Zaria using the procedure described by [8]. Also Nitrogen level of the urine was carried out using the

procedure described by [8]. The data collected were subjected to analysis of variance (ANOVA), using General Linear Model [9].

Result and Discussion

The proximate composition of the experimental diet is shown in Table 2. The result shows that DM ranges between 92.15 – 95.08, The crude fibre (CF) increases as the ratio of Crotalaria:concentrate increases in the diet, while the ether extract and Nitrogen free extract (NFE) decreases as the ratio of Crotalaria:concentrate increases, this result is in line with the report of [10] for tropical legumes.

Table 2: Proximate composition of Experimental Diets and Crotalaria leaves.

Nutrients (%)	Treatments				
	T1	T2	T3	T4	Crotalaria
Dry matter	93.66	92.15	95.08	94.56	94.78
Crude protein	16.06	16.81	15.31	15.38	18.00
Crude fibre	4.95	7.95	8.93	11.65	12.75
Oil	4.10	3.47	2.19	2.09	0.60
Ash	6.87	10.23	21.77	19.01	2.98
Nitrogen free extract	68.02	62.41	51.80	51.87	65.17

The feed intake and weight gain of Red Sokoto goats fed the experimental diets are shown in Table 3. Feed intake and weight gain were influenced significantly ($P<0.05$) by dietary treatments. Intake recorded for T_1, T_2, T_3 and T_4 were 2178.50, 2118.0, 1882.50 and 1476.0g respectively. The feed intake decreased as the ratio of the *Crotalaria*:Concentrate increases. Final weight showed a significant ($P<0.05$) increase across treatments with T_4 having the highest values (17.15kg) and T_1 the least (14.05kg). However average weight gain decreases as the ratio of the *Crotalaria*:Concentrate increases, T_2 recorded the highest weight gain (0.65kg) which significantly ($P<0.05$) differ with T_4. This result is in line with the report of [11] who observed that the average intake of a diet and the efficiency of its utilization are largely determined by the relative balance of energy and other essential nutrients absorbed by the animals.

Table 3: Performance characteristic of Red Sokoto Goats Fed the Experimental Diets

Parameters	Treatments				
	T_1	T_2	T_3	T_4	SEM
Initial weight (kg)	13.40[d]	14.50[c]	16.40[b]	16.85[a]	0.071*
Final weight (kg)	14.05[d]	15.15[c]	16.95[b]	17.15[a]	0.095*
Weight gain (kg)	0.55[a]	0.65[a]	0.55[a]	0.30[b]	0.069*
Feed intake (g)	2178.50[a]	2118.00[a]	1882.50[a]	1476.00[b]	49.52*
Feed conversion efficiency	0.23	0.31	0.29	0.20	

[a,b,c] Means within row with different superscript are significantly different ($p<0.005$), SEM = Standard Error of means. * = $P<0.05$

The nutrients digestibility of the experimental diet is shown in Table 4. The DM, OM, CP, and CF digestibility were affected significantly ($P<0.05$) by the level of crotalaria in the diets. The digestibility of all nutrients significantly ($P<0.05$) decreased as the ratio of Crotalaria:concentrate increases in the diets. Thus reflecting poor degree of utilization of nutrients due to reduced ratio of concentrate in the diets and possibly as a result of the presence of some anti-nutritional factors in the diet [12]. It has also been reported that an inverse relationship existed between nutrient consumption and digestibility [13].

This observation however was not in consonance with the apparent digestibility values obtained in this study when compared to the nitrogen intake of goats within the various treatment groups.

Table 4: Nutrients digestibility of Animal Fed Experimental Diets

Nutrient	Treatments				
	T_1	T_2	T_3	T_4	SEM
Dry Matter	75.59[a]	72.75[b]	72.15[b]	70.16[b]	1.53*
Organic Matter	78.55[a]	74.26[b]	70.28[c]	69.99[c]	1.57*
Crude Protein	71.97[a]	70.69[ab]	65.61[ab]	59.91[b]	1.71*
Crude Fibre	60.25[a]	54.45[b]	53.66[b]	29.14[c]	2.86*

[a,b,c] Means within row with different superscript are significantly different ($p<0.005$), SEM = Standard Error of means. * = $P<0.05$

Table 5 shows the nitrogen balance of Red Sokoto goats fed the experimental diets. The total nitrogen intake differed significantly ($P<0.05$) among treatment diets. There was no significant ($P>0.05$) difference in total Nitrogen intake by

animals on T_2, T_3 and T_4. However feacal nitrogen increased significantly ($P<0.05$) with increase in the levels of crotalaria. On the other hand, urinary nitrogen were influenced significantly ($P<0.05$) by dietary regimen but not in a definite pattern and the observed values were lower for T_3 relative to other treatment diets. Nitrogen excreted in urine would depend on urea recycling and the efficiency of utilization of ammonia produced in the rumen by microbes for microbial protein synthesis. There was no significant difference ($P>0.05$) in nitrogen retention values in animals fed T_3 (215.05) and T_2 (213.13) diets. However, these were significantly ($p<0.05$) higher than that recorded in animals fed diet in T_4 (165.63) and T_1 (144.06). The positive values obtained for all treatment groups suggest that the maintenance requirements of the experimental animals were adequately met by the diets and this is buttressed by the fact that none of the experimental animals experienced weight loss during the digestive trial.

Table 5: Nitrogen Balance of Red Sokoto goats fed Experimental Diets

Parameters	Treatments				SEM
	T_1	T_2	T_3	T_4	
Total nitrogen intake	226.05^{b}	316.45^{a}	333.05^{a}	325.75^{a}	17.68*
Fecal nitrogen	65.85^{b}	92.18^{ab}	115.09^{a}	130.96^{a}	5.81*
Urinary nitrogen	16.14^{b}	11.14^{b}	8.39^{c}	29.16^{a}	2.55*
Nitrogen retention	144.06^{c}	213.13^{a}	215.05^{a}	165.63^{b}	9.32*
Nitrogen retention % of intake	32.96^{b}	35.15^{b}	35.43^{b}	49.05^{a}	2.44*
Apparent N digestibility	71.97^{a}	70.69^{ab}	65.61^{ab}	59.91^{b}	1.71*

^{a,b,c} Means within row with different superscript are significantly different ($p<0.005$), SEM = Standard Error of means. * = $P<0.05$

The values for the N-retention % of intake similarly shows that they were significantly ($p<0.05$) affected by the diets, and show a decrease with increase in the level of crotalaria. Apparent-N-digestibility (%) value was significantly different ($p<0.05$) for goats fed T_1 diet (71.97) relative to T_4 (59.91). The result of apparent-N-digestibility shows a decreased with increased in the ratio of crotalaria:concentrate in the diets. Apparent-N-digestibility values for the diets were high, ranging from 71.97% in T_1 to 59.91% in T_4, indicating a better utilization by the animals.

Conclusion and Application

The result of this study shows that the incorporation of *Crotalaria retusa* leaves meal in the diet of Red Sokoto goats generally improved performance. However, the best level of inclusion is 40% Crotalaria:60% concentrate ratio.

References

1. Okoli I.C, Ebere, C.S,Uchegbu M.C, Uddah C.A and Ibeaewuchi I.I (2002) Survey of the diversity of plants utilized for small ruminant feeding in south eastern Nigeria. *Agriculture Ecosystem and Environment* 45(6): 25-29

2. Fadiyimu A.A and Alokan J.A(2007) Evaluation of medicinal plants,Moringa oleifera as replacement for Panicum maximum in west African Dwarf sheep diets.Proceedings,Akure-Humboldt Kelog, 3rd SAAT Annual comf. Federal Univ. of Tech. Akure Nigeria.16th -19th April 2007.

3. Oji, U.I. and Isilebo, J.O. (2000). Nutrient characterization of selected browse plants of the humid tropics. In Proc. 27th Annual NSAP conference, 18th - 21st March 2000, Umudike, Nigeria. pp.54-56.

4. Milford, R. (1967). Nutritive value and chemical composition of seven tropical legumes and leu cer na grown sub tropical south eastern Quennsland. *Aust.J.of experimental Agriculture and Ainimal husbandry* 7:540-547.

5. Abukutsa-Oyango M.O.(2003). Unexploited potential African vegetable in western Kenya. *Journal of education, Art and sciences*.21: 32-37.

6. Atta-Krah, A.N. (1989). Fodder trees and shrubs in tropical Africa: Importance, availability and patterns of utilization, Integration of livestock with crops in response to increasing population pressure on available resources, CTA-Seminar proceedings, Mauritius, pp118-138

7. Yashim, S.M and Jokthan, G.E. (2010). Effect of different parts of plant on the nutritive value of rattle box (Crottalaria retusa) plant. In: Proc. 15th Annual ASAN conference, 13th – 16th September, 2010, University of Uyo, Nigeria. Pp 677 – 678.

8. AOAC, (2000). Official Methods of Analysis, 17th ed. Association of Official Analytical Chemists.Washington, DC

9. SAS (2000). SAS User's Guide: Statistics. SAS Institute, Cary, North Carolina, USA

10. Oddy V.H and Saniz R.D.(2002). Nutrition for sheep meat production ,In: sheep nutrition (Feer,M and Dowe H. ed).CSIRO publishing pp 237-262

11. Rogosic, J., Estell, R.E., Skobic, D., Martinovic, A., Maric, S. (2006). Role of species diversity and secondary compound complementarity on diet selection of Mediterranean shrubs by goats. *J. Chem. Ecol.* 32, 1279–1287.

12. Sodeinde, F. G., Asaolu, V.Oladipo, M.A., Akinlade, J.A., Ige, A.O., Amao, S.R. and Alalade, J.A. (2007). Mineral and antinutritional contents of some forage legumes consumed by small ruminants in the derived savanna of Nigeria. *Research Journal of Agronomy 1 (1) 30-32.*

13. McDonald, P., Edwards, R.A., Greenhalgh, J.F.D. and Morgan, C.A. (2002). Animal Nutrition. 6th edition. Pretence Hall.