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Replacing Cotton Seed Cake with Cassava Leaf Meal in Corn Bran Based Diet Fed to the Goat

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Abstract

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A 56-day dry matter and nutrients intake and digestibility, nitrogen retention and growth performance study was carried out to assess the replacement value of cassava leaf meal for cotton seed cake in a corn bran-based concentrate diet fed to goats. Twenty male West African Dwarf goats aged, 6 - 8 months with average initial live weight of 8.74 ± 0.41 Kg were divided into five dietary groups comprising of four treatments plus a control. Treatments consisted of cassava leaf meal that was used to replace increasing percentage levels (25, 50, 75 and 100) of crude protein supply from cotton seed cake in the control diet. The control and treatment diets at 0, 25, 50, 75 and 100 % replacement levels were designated as A, B, C, D, and E respectively. The effects of treatments on dry matter intake were similar ($P > 0.05$) but differed ($P < 0.05$) on dry matter digestibility (57.24, 61.71, 65.11 66.14 and 68.83 at 0, 25, 50, 75 and 100 % replacement levels respectively). Crude protein digestibility (%) was highest (59.77) for goats on Diet C in which 50 % of the cotton seed cake was replaced with cassava leaf meal and lowest for those on the control Diet A (48.72). Efficiency of feed conversion was higher ($P < 0.05$) for goats in groups B, C, D or E receiving cassava leaf meal treatment than for the control group, A. Nitrogen retention (g/day) improved ($P <0.05$) from 2.74 in the control group to 3.05 and 3.51 in goats on Diets C and D respectively resulting in 26 and 45 % body weight gain advantage over the control group. The results indicated that cotton seed cake could be successfully replaced with cassava leaf meal in the diets of West African Dwarf goats as reflected in improved dry matter and crude protein digestibility, nitrogen retention and body weight gain with a higher efficiency of feed conversion. A 100 % replacement level was shown to be feasible.

Key words: cassava leaf meal, cotton seed cake, maize offal, goat

Introduction

The sustenance as well as the prospect for improvement of the level of livestock production in a resource poor developing country like Nigeria depends on the use of unconventional feed resources. In other to safe cost and achieve reasonable economic returns from ruminant livestock production, farmers must continuously explore the potentials of the various feed resources in his immediate environment with the aim of reducing competition for conventional feeds/feedstuffs between ruminants and other livestock species.

Cassava foliage, a waste product of cassava plant farming has little or no economic value as over 90 % of the leaves are often left on the field to decay after cassava tuber harvest. The percentage of cassava leaves from the total cassava foliage production, presently being used in human and livestock diets is relatively low. While cassava farming is a major occupation of the people of southern and northern Nigeria with a higher level of production in the south, cotton plant production is concentrated in the north. Incidentally, cassava leaf meal and cotton seed cake are equally rich in crude protein - a major limiting nutrient to ruminants on fibrous crop residues and agro-industrial wastes. Reported crude protein contents of cotton seed cake and Cassava leaf meal were 21.20 % (Alawa et al., 2002) and 23.4 % (Ngi et al., 2006) respectively. It can therefore be anticipated that goat farmers from Cassava growing regions in Nigeria and elsewhere in Africa will derive benefits from the use of cassava leaf meal in place of cotton seed cake while formulating ruminant diets with corn bran. The aim of the present study was to observe changes in feed intake, nutrient digestibility, nitrogen retention and growth performance characteristics in West African Dwarf goats fed corn bran-based complete diet in which increasing levels of cassava leaf meal were used to replace cotton seed cake. It is envisaged that a successful replacement of cotton seed cake with Cassava leaf meal would reduce cost of feeding goats and encourage integration of goat production with cassava farming.

Materials and Methods

Site of the Experiment

The feeding trial was conducted at the Animal Pavilion of the Department of Animal Production, University of Ilorin, Ilorin Nigeria (8.29^{o}N, 4.31^{o} W) during the dry season months of November, 2004 - January 2005.

Processing cassava leaves

Cassava leaves were obtained from the University Teaching & Research farm, University of Ilorin, following cassava tuber harvest, from 9-month old Cassava plants. The leaves separated from twigs and stalks were sun dried for three days and ground in a hammer mill to allow for proper mixing with the other dietary ingredients.

Animals and Treatments

Twenty male West African Dwarf goats (6 - 8 months old) with average initial live weight of 8.74 ± 0.41 kg (about 45 % of adult live weight), were treated against internal and external parasites using a long acting antibiotic - Oxytetracycline (Pfizer Products), an acaricide - Asuntol (Bayer Products) and an antihelmitics - Banmith (Pfizer Products). Goats were divided into five groups of four animals per group with each group as-

signed randomly to one of five dietary treatments. Treatments consisted of cassava leaf meal that was used to replace cotton seed cake at 0, 25. 50, 75 and 100 % crude protein content in a corn bran - based complete diet forming diets A, B, C, D and E respectively. Goats were housed individually in a concrete floor pen during the first 21 days and latter transferred to individual metabolism cages that allowed for total collection of faeces during the following 7- day digestibility study that was preceded by a 3-day period of adaptation to cage conditions. Goats were fed at 3 % of their body weights having unrestricted access to clean drinking water and mineralized salt lick throughout the 56-day feeding trial.

Collection of Data and Analyses

Records of daily feed intake were prepared for each goat from the differences between feed offered and refusals. Total faeces voided by each goat during the 7-day collection period were collected and weighed daily. A 10 % aliquot of the daily faecal output was oven dried at 600 for 48 hours, ground to pass through a 2 mm sieve, bulked for the individual goats and preserved for determination of dry matter and proximate compositions. Samples of cassava leaves meal, feeds and faeces were analyzed for dry matter, crude protein and crude fiber contents (AOAC, 1984). Energy values of the diets were determined in a Ballistic bomb calorimeter using benzoic acid as standard. Data were analyzed statistically (Steel and Tories 1960) as in a completely randomized designed experiment with treatment means, separated using the Duncan's (1955) multiple range test.

Results and Discussion

Component and chemical compositions of treatment Diets A, B, C, D and E are shown in Table 1. Cassava leaf meal was included to supply 0, 25, 50, 75 and 100 % respectively, of the crude protein from

Table 1
Compositions of experimental diets

Item/ Replacement level	A (0 %)	B (25 %)	C (50 %)	D (75 %)	E (100 %)
Corn bran	67.88	67.54	67.2	67.84	66.5
Corn, ground	10	10	10	10	10
Cotton Seed cake	11.12	8.34	5.56	2.78	_
Cassava Leaf Meal	_	3.12	6.24	9.38	12.5
Rice Husk	10	10	10	10	10
Salt + Bone meal (1:1)	1	1	1	1	1
TOTAL	100	100	100	100	100
Energy and Chemical Composition					
Dry matter	91.67	90.85	92.44	92.17	92.56
Crude protein, %	12.01	12	11.96	11.92	11.88
Crude fibre	14.27	13.74	13.48	13.27	12.92
Ether extract	3.75	3.62	3.66	3.53	3.48
DE Mcal/kg	4.03	4.06	4.08	4.11	4.123

cotton seed cake in the control diet. Diets were formulated to be isocaloric (4.03 ± 0.04 Mcal /kg GE) and isonitrogenous (11.96 ± 0.06 % CP). Corn was included in the diets to increase fermentable energy contents while rice husk provided long fiber for rumen functioning. From the NRC (1984) table of nutrients requirements, the energy and protein levels of the experimental diets would probably be sufficient for the goats' body maintenance plus weight gain (50 g /head / day) at dry matter intake of 3 % body weight.

Diets were equally relished by the goats; having an average daily dry matter intake (kg /100 kg BW) of 3.82 ± 0.83 (Table 2). Mba et al. (1982) had obtained dry matter intake of 3.78 kg per 100 kg body weight for West African Dwarf goats of similar body sizes maintained on Gliricidia sepium plus concentrate (1:1) ration. Percentage dry matter digestibility increased (P<0.05) from 57.24 in the control group to 65.11, 66.14 and 68.83 in goats receiving diets C, D and E respectively in which cassava leaves meal was used to provide 50, 75 and 100 % of crude protein from cotton seed cake in diet A. Crude protein digestibility values of 59.77, 58.36 and 58.17 obtained for goats on diets C, D and E respectively, were each significantly (P<0 .05) higher than the value of 48.72 in the control group on Diet A. Improvements in dry matter and crude protein digestibility could be attributed to positive influences of cassava leaf meal on rumen environment in the goats. Fasuyi (2005) had reported relatively high concentrations of such mineral elements as Zinc (26 ppm) and Nickel (20 ppm) in cassava leaves which could be beneficial to the rumen microbial populations and thereby have aided the digestion of diets. Preston and Leng (1987) noted that the availability of nutrients from a diet is dependent on microbial ecosystem in the rumen. Nickel has

Table 2

Dry matter intake and Nutrient Digestibility by Goats at Different Dietary Levels of Cassava leaf meal

Index / Diet	A (0 %)	B (25 %)	C (50 %)	D (75 %)	E (100 %)	SEM
Dry matter Intake, g /kg BW/day	2.91	2.96	3.01	2.85	2.95	0.83
Digestibility, %	57.24^{b}	59.71^{b}	65.11^{a}	66.14^{a}	68.83^{a}	2.11
Crude protein						
Intake, g/kg BW/day	3.81	3.92	3.88	3.69	3.79	0.16
Digestibility, %	48.72^{b}	51.26^{b}	59.77^{a}	58.36^{a}	58.17^{a}	1.87
Crude Fiber						
Intake, g/kg BW/day	4.53	4.48	4.37	4.09	4.19	1.18
Digestibility, %	61.77	62.75	62.86	63.14	63.65	4.53
Ether extract						
Intake, g/kg BW/day	1.19	1.82	1.19	1.09	1.11	0.24
Digestibility, %	60.27	61.46	61.66	61.86	62.15	0.97

a, b, c- Means along a row with different superscripts, differed significantly (P< 0.05)

been reported to be essential for the activities of urease enzyme resulting in efficient recycling of endogenous ammonia across the rumen epithelia (Nolan and Leng, 1972) and increased production of volatile fatty acids (Nielson et. al. 1989) while Zinc is identified (Van Nevel and Demeyer, 1988) as an inhibitor of proteolysis in the rumen. Effects of treatments on digestibility of crude fibre or ether extract were not significant ($P > 0.05$) but values obtained tended to increase with the level of cassava leaves meal in the diets.

The effects of treatments on body weight gain by the goats were significant as shown in Table 3. Goats on Diets C and D gained in body weights similarly but each at a faster ($P < 0.05$) rate than those on Diet B or D. The control group receiving 100 % un-replaced Cotton seed cake had the least rate of body weight gain. Percentage increases in average daily weight gain by goats receiving Cassava leaf meal treatments over the control group were; 37.98, 51.83, 50.41, and 32.13 for treatment groups B, C, D and E respectively. Differences in average daily weight gain by the goats could be attributed to the influence of Cassava leaf meal in providing essential nitrogen and mineral elements both for effective rumen function (Norton, 1994) and for body metabolism by the animals. High concentrations of mineral elements such as Calcium, Magnesium, Manganese, Zinc and Nickel had been reported (Ravindran, 1990; Fasuyi, 2005) for Cassava leaves. Eggum (1970) also reported that about 85 % of the total protein in Cassava leaves is in the form of true protein. The superior nutritive quality of Diets C and D over the control Diet A was reflected in the higher ($P < 0.05$) nitrogen retention values obtained and which was positively translated in to improved ($P < 0.05$) body weight gain. Detailed assessment of cassava leaves meal against

Table 3
Influence of leaf meal supplements on growth performance and nitrogen economy of goats

Item/Diet	A (0 %)	B (25 %)	C (50 %)	D (75 %)	E (100 %)	SEM
Growth Performance						
Initial weight, kg	8.84	8.72	8.81	8.86	8.77	0.23
Final weight, kg	10.21	10.61	10.89	10.92	10.58	1.11
Weight gain, g/day	24.46^{c}	33.75^{b}	37.14^{a}	36.79^{a}	32.32^{b}	1.26
Dry matter intake, kg/day	308.47	315.43	319.71	305.88	309.03	14.18
Feed : Gain	12.61^{a}	9.35^{b}	8.61^{b}	8.31^{b}	9.56^{b}	1.32
Nitrogen economy, g/day						
N - intake	5.93	6.06	6.12	5.83	5.87	0.16
Fecal – N	1.81	1.66	1.36	1.07	1.36	1.52
Absorbed – N	4.12	4.39	4.76	4.76	4.51	0.68
Urinary – N	1.38^{b}	1.42^{b}	1.71^{a}	1.15^{c}	1.47^{b}	0.14
Retained - N	2.74^{b}	2.98^{b}	3.05^{a}	3.51^{a}	3.04^{ab}	0.11

a, b, c ---Means along a row with different superscript letters are different ($P < 0.05$).
SEM --- Standard error of treatment means.

Cotton seed cake to determine the effects of long term treatments on tissue and organ development, reproduction and milk production in the goats would be appropriate in the subsequent studies.

Conclusion

Results from the experiment showed that cassava leaf meal can be a suitable substitute to cotton seed cake while formulating rations based on corn bran for the goat. Goats receiving diets in which cassava leaf meal replaced 50 or 75 % of the crude protein contribution from cotton seed cake had higher coefficients of dry matter and crude protein digestibility, nitrogen retention and body weight gain than the control.

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