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Growth Performance of Yankasa rams fed varying Proportions of *Gmelina aborea* Leaves

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Target Audience: Animal nutritionists, Livestock farmers, Extension agents.

Abstract

Twenty Yankasa rams weighing average 15.50kg ±2 were used to study the effect of replacing Maize stover (MS) with wilted Gmelina aborea leaves (GAL) at 0, 15, 30, 45 and 60% on dry matter intake, growth performance of rams, digestibility and utilisation of nitrogen. The rams were randomly assigned into five groups with four rams per group. The experimental diets consist of Maize Stover as a basal diet which were replaced with wilted Gmelina aborea leaves (GAL) at 0, 15, 30, 45 and 60%. The basal diet was fed at the rate of 2% body weight per head daily. The animals were offered supplement at the rate of 1% of body weight per head daily. The trial lasted for 90 days. Metabolism study was subsequently conducted using 18 animals from those used for the feeding trial. .The proximate composition showed that the GAL had 93.71, 5.39, 13.60, 17.15, 23.00, 65.14, 32.30 and 34.48% of dry matter (DM), ash, ether extract (EE), crude fibre (CF),crude protein (CP), Neutral Detergent fibre (NDF), Acid detergent Fibre (ADF) and Nitrogen Free extract (NFE) respectively. The result of feeding trial indicated that animals fed the 45% GL consumed more (P<0.05) Dry matter than the animal fed 0, 15 30 and 60% GL the LWG of the rams range from -20.48-6.95g/d .The result depicted the apparent digestibility of dry matter was high (p<0.05) for animals fed sole GL and had the best digestibility of all nutrients except CP. It can be concluded from the two trials that Gmelina aborea leaves can be included in the diets of Yankasa sheep up to 60% without adverse effect on intake, digestibility of nutrients and growth.

Keywords: *Gmelina aborea leaves, Maize Stover Yankasa sheep*

Description of Problem

Two of the major problems facing small ruminant production in Nigeria are nutrition and health (1).The supplementary feeds with high protein and energy content such as oilseed cake, cereal by-products and brewers' grains which can be used to alleviate the effect of the long dry season are scarce, costly and sometimes adulterated.

Supplementation of tropical roughages with leguminous fodder trees and shrubs known as Multipurpose trees (MPTS) is a way of alleviating nitrogen deficiencies (2).These multipurpose trees are high in crude protein contents (12-30%) compared to matured tropical grasses (3-7%) hence they are important feed resources that could be harnessed by cut and carry to bridge the seasonal deficits (3).

The importance of trees and shrubs in feeding ruminants, especially during dry season has been recognized by livestock owners, largely the Fulani herdsmen. These people are known internationally for utilizing the branches of trees for their animals at the critical period of feed scarcity. *Gmelina aborea*, one of the trees found in many parts of Nigeria could provide a significant amount of biomass for small ruminant feeding during the dry season.

Gmelina aborea is a perennial leguminous tree, particularly notable for its fast growth, large green leaves and very high dry matter yield (4). It is commonly used as shade tree in houses, because of its canopy. Its trunk is used also in the paper industry. However, the leaves, which are always in large quantities, are not being put into use (5). Information on its nutritive value, digestibility and utilization by animal is also scanty. This study was designed to investigate the intake, weight gain, digestibility and nitrogen utilization of Yankasa sheep by feeding varying proportions of *Gmelina aborea* leaves and maize Stover as basal diets.

Materials and Methods

Experimental site

The experiment was conducted at the Small Ruminant Research Programme farm of the National Animal production Research Institute (NAPRI) Shika, Zaria. Chemical composition of the *Gmelina aborea* leaves analysis was carried out at Central Laboratory Unit, NAPRI and Biochemical Laboratory of the Animal Science Department, Ahmadu Bello, University. Zaria. Shika is geographically located between latitude 11^0 and 12^0, longitude 7^0 and 33^0E and at an altitude of 640m above sea level.

Management of the experimental animals

Twenty Yankasa rams of average weight 15.50kg $\pm$2 were used for the experiment. The animals were obtained from the flock raised at NAPRI, Shika. The animal were dewormed with anthelmintics Albendo® (Albendazole) to control *endoparasites* and ivomectin (Ivomec®) to control *ectoparasites.*

The animals were housed individually in an open sided well ventilated run. The pens were cleaned, washed and disinfected with *izal* solution before the arrival of the animals. The sheep were allowed an adaptation period of two weeks during which they were fed with the experimental diets. During the adaptation period the animals had free access to fresh water.

Experimental feed and design

The animals were weighed, and randomly selected to five groups, with four animals per group in a completely randomized experimental design. The experimental diets consist of maize stover as basal diet, which were replaced with wilted *Gmelina aborea* leaves at 0% (control), 15, 30, 45 and 60%. The basal diet was fed at the rate of 2% of body weight / head /day. The animals were offered supplementary diet at the rate of 1% of body weight per head daily, throughout the feeding trial period which lasted 90 days. The supplement consisted of maize (29.18%), wheat offal (58.38%), cottonseed cake (10.94%), bone meal (1.0%) and salt (0.5%).

Experimental procedure

The diets were offered to the animals daily between 0800 and 900 hours. During each feeding time animals were first given concentrate ration and subsequently, *Gmelina aborea* leaves and followed by maize stover in a separate trough in the pens. Water was offered *ad libitum* and changed every morning. The residues of the previous day's feed were removed and weighed. The animals were weighed at the beginning of the trial and at two weeks interval using a hanging scale.

Digestibility and nitrogen balance

At the end of feeding trial eighteen animals were randomly selected for digestibility and nitrogen balance studies. The animals were transferred to individual metabolism crates. Animals were allowed 14 days to adjust to the new environment. Measurements were taken for a period of seven consecutive days. Left over feed were weighed and recorded daily before the morning feeding. Total fecal output was collected daily in the morning, weighed and mixed thoroughly. The total fecal samples collected over seven days were collected, bulked and sub-samples taken. About 20%, formaldehyde was added to the sub-sample to prevent further bacterial activities and this was stored (- 4^0C) in a deep- freezer.

Urine output for 24 hours was collected with Plastic buckets containing 0.1N concentrates H_2SO_4 acid placed under the metabolism crates. Ten percent (10%) of daily urine output were taken from each ram and stored in a refrigerator for the period of the digestibility trial. At the end of the 7 days collection period, 10% of the urine sample was taken from each of the ram, sub-sampled for analysis.

Laboratory analysis

Feed samples were oven-dried at 70^0C for 48 hours and milled through a 2.5mm sieve. Dry matter content of the dried feed samples and feaces were determined by drying at 60 ^{0}c for 48 hours. Nitrogen content of the feed samples and urine were determined using Kjeldahl procedure (6). The samples were ashed by charring in muffle furnace at 500^0C for about 3 hour. Ether-extract and crude fiber of the samples were analyzed according to (6) procedure. The Acid detergent fiber (ADF) and Neutral detergent fiber (NDF) of feed samples, and feaces were analyzed according to the procedure of (7).

Statistical Analysis

Data collected during the growth and the digestibility trials were subjected to one-way analysis of variance (ANOVA) procedure (8) and Duncan multiple range tests (DMRT) was used to compare treatment means (9). for significant difference among treatments means.

Results and Discussion

The nutrient composition of maize stover (MS) and *Gmelina aborea* leaves (GAL) fed to Yankasa rams is shown in Table 1.The value of crude protein in GAL was higher than that of maize stover. GAL had a lower CF, NDF, ADF and NFE. The highest dry matter content in MS was slightly higher than that in GAL.

Content of dry matter in maize stover used in this study was expected, as it was collected in dry form. The crude protein (CP) of *Gmelina aborea* leaves (GAL) reported in this study (Table 1) was higher than the CP (14.11%) reported by (10) and lower than the GAL value (26.69%) reported by (11) .The NDF GAL values of this trial was similar to the GAL value (65.86 %) reported by (12). The DM and NDF values of GAL in this trial were slightly higher than values 91.60% DM and 55.76% NDF, reported by (13). The little differences noticed in the chemical composition in this trial may be due to a variation in the stage of growth of the plants and type (i.e. twigs leaves or soft stem) of foliage sampled and, site of sampling (14) and/or proportion of foliage materials sampled (15) .

Table 1: Chemical Composition of Maize Stover and *Gmelina aborea* leaves

Parameters	Maize stover	*Gmelina aborea* leaves
Dry Matter	94.49	93.71
Ash	1.87	5.39
Ether extract	11.21	13.60
Crude fibre	29.48	17.15
Crude protein	3.78	23.00
Neutral detergent fibre	70.01	65.14
Acid detergent fibre	58.15	32.30
Nitrogen free- extract	53.66	34.48

Table 2 shows the results of feed intake of Yankasa rams. The results of the feeding trial showed that the dry matter intake (DMI) was marginally improved (P<0.05) by inclusion of GAL in the diets up to a peak on the diet containing 60% GAL. The highest DMI was recorded on diet containing 60%GAL. Rams in control diet had the highest (P<0.05) MS intake and statistically significant. Rams fed diets containing 45 and 60% GAL were statistically similar (P>0.05) in MS intake. Intake of supplement feed was not statistically different (P>0.05).

The results of weight changes are also presented in Table 2.The average weight gain observed in this study ranged between 2.78g and 6.95g /head/day was statistically significant (P<0.05).Rams on diet containing 45 and 60% GAL had an average daily weight gain of 6.95g and 2.78g, respectively, while the rams on the other diets lost weight. The calculated nutrient digestibility coefficient is presented in Table 3. The digestibility trial inclusion of GAL had significant effect (P<0.05) on apparent digestibility of DM, CP, EE and CF. The digestibility was slightly higher (P<0.05) in animal fed sole *Gmelina aborea* leaves 60% and those fed 45% GAL .*The* least value of (P<0.05) digestibility of CF, CP and EE were recorded in rams fed the control diet followed by those fed diet containing 15% GAL.

Table2. Feed intake and Weight changes of rams fed varying proportions of *Gmelina aborea* leaves and Maize Stover.

	Experimental diet					
Parameters	0	15	30	45	60	SEM
Supplements (g/day)	140.79	166.32	149.16	159.57	171.07	87.48
GAL (g/day)	0.00	52.46^{d}	101.04^{c}	144.8^{b}	210.67^{a}	76.37
MS (g/day)	215.37^{a}	212.68^{a}	220.22^{a}	130.85^{b}	98.27^{b}	66.93
Total DMI (g/day)	356.16^{b}	431.46^{ab}	470.46^{a}	435.22^{ab}	480.01^{a}	58.92
Initial (kg)	16.85	17.87	16.75	18.5	18.25	1.11
Final (kg)	15.00	17.62	15.62	18.87	18.5	1.39
Tot. Gain/loss (kg)	-1.85^{d}	-0.5^{c}	-0.35^{d}	0.62^{a}	0.2^{ab}	0.28
Aver. Daily gain (g)	-20.48^{d}	-2.75^{c}	-12,5^{d}	6.95^{a}	2.78^{b}	0.60
Feed conversion ratio (g)	- 188.3	-142.7	-10.9	71.5	83.2	

a ,b ,c, Means within the same row bearing different superscripts are significantly different (P<0.05) SEM :standard error of means

Table 3: Effect of *Gmelina aborea* leaves inclusion on nutrient digestibility coefficient by Yankasa rams fed maize stover.

Nutrients	Experimental diets						SEM
	0	15	30	45	60	100	
Dry matter (%)	29.13^{c}	40.05^{b}	40.50^{ab}	47.89^{ab}	58.37^{a}	59.82^{a}	12.2
Ether extract (%)	14.12^{b}	23.48^{b}	23.82^{b}	38.29^{ab}	45.73^{ab}	57.78^{a}	42.84
Crude fibber (%)	24.65^{a}	10.24^{b}	7.90^{b}	24.18^{a}	23.60^{a}	28.95^{a}	13.40
Crude protein (%)	21.18	28.97	42.86	41.51	58.07	49.37	64.14

a, b, c Means within the same row with different superscript are significantly different (P<0.05) SEM: standard error of means

The result of the nitrogen balance in this study (Table 4) depicted that the total N intake was statistically significant (P<0.05) among the treatment groups. The total nitrogen intake consistently increased as the level of GAL increased. Rams fed sole *GA*L diet recorded the highest (P<0.05) daily nitrogen outputs. The daily values for nitrogen indicated that all the animals were in positive nitrogen balance. Rams on sole diet had the highest (P<0.05) daily fecal N followed by those on 30, 60 and 45%GAL diets. The differences between them was statistically significant (P<0.05).There was a significant (P<0.05) difference in total fecal N across treatment with animals on sole GAL having the highest output.

The findings from this study on GAL found were relished by sheep. On the average, the animals consumed more of the diet as the inclusion level increased. This also lead to increased GAL intake by the sheep, as well as increased DM intake Effect of treatment significantly influenced the DM intake, The lowest DM intake by animals in the control group could be ascribed to the low CP content of the control diet compared to the supplemented diets. The improvement in DMI observed in this study due to inclusion of browse plant has also been reported when *Leucaena* was fed to goats (16) and cattle (17). Since GAL had higher crude protein (23% CP) relative to maize stover (3.78%), increasing its levels of inclusion led to increase in CP content of the diets. This apparent effect of dietary crude protein agreed with earlier reports of (18, 19) which demonstrated the influence of dietary crude protein or nitrogen level on DMI

The average live weight gain reported in the present trial is low .This could not have been due to decreased Dry matter, Crude Protein intake and nutrient utilization, but as a result of lice and worm infestations occurred during the feeding trial . The result is an indication of the influence of parasites on performance of rams.

The low live weight gain obtained in this study supported the report of (20) that, gastrointestinal nematodes impose severe economic constraints on sheep production worldwide, Leading to Production losses through mortalities and reduction in live weight gain. It also corroborates the findings of (21) that exhibited the economic loss due to worm loads, high death rate, reduction in growth rate, reduction in milk production and non-efficient utilization of feed.

Digestibility of DM and EE followed the same pattern observed in Table 3. Several workers have reported on the influence substitution level of crop residues on digestibility. Animal on 60%GAL diet gave better crude protein digestibility (CPD) than those on the other diets this may be due to ability of the GAL to effectively stimulate additional microbial protein synthesis. The highest DM digestibility was obtained in animals fed sole *Gmelina aborea* leaves diet and this agreed with the studies of (16) where graded levels of browse (*Leucaena or Gliricidia*) were mixed with native grass for WAD goats improved digestibility compare to the control.

The daily values for nitrogen balance (Table 4) indicated that all the animals were in positive nitrogen balance. The observed consistent increase in nitrogen retention with increasing nitrogen or crude protein intake supports earlier reports by (22, 23) They noted that animals fed sole diet of *Gliricidia* had the highest nitrogen intake, and nitrogen retention compared to those that received concentrate supplement in addition. Lowered retention value for the control fed sheep could be as a result reduced of utilization of dietary protein by microbes. The mean daily values of urinary nitrogen (2.60-4.70) for this study were higher than (1.09-2.57) WAD kids fed *Gliricidia*-concentrate diet (24) .However; they are lower than 3.60-7.60g/day obtained for rams fed supplements containing fishmeal (25).

Table 4: Nitrogen utilisation by Yankasa rams fed varying proportions of *Gmelina aborea* leaves and Maize Stover in g/day

Parameters	Treatment diets						SEM
	0	15	30	45	60	100	
Nitrogen intake	86.18^{d}	123.01^{cd}	132.71^{c}	148.00^{b}	191.95^{ab}	229.93a	10.27
N losses in faeces	69.49^{b}	90.98^{b}	70.06b	84.69^{b}	67.91^{b}	128.87^{a}	58.37
N losses in urine	2.60	3.61	3.68	3.58	4.74	2.68	0.63
Total N output	158.57^{c}	227.30^{b}	190.75b^{c}	236.27^{b}	264.60^{b}	361.48a	19.32
Nitrogen Balance	15.79^{c}	40.45^{c}	52.25^{bc}	61.26^{bc}	99.98^{b}	121.51^{a}	13.69
N-ret. as % of intake.	18.42^{b}	27.82^{b}	42.30^{ab}	39.84^{ab}	63.29^{a}	43.64^{ab}	42.24

a, b, c and d Means within the same row with different superscript are significantly different (P<0.05) SEM: standard error of means

Conclusion and Application

This study established that:

1. At 60% inclusion level of *Gmelina aborea* leaves feed

intake crude, protein digestibility and nitrogen retention values observed were better than those observed for animal on the control diet.

2. Maize stover can be supplemented with *Gmelina aborea* leaves at 60% GAL to successfully improve performance of sheep.

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