



## FEEDING NAPIER GRASS TO SMALL RUMINANT ANIMALS IN DRIER PARTS OF BAUCHI STATE AS A MITIGATION TO HERDER-FARMER CRISES

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### ABSTRACT

The paper analyzed the feeding of Napier grass to small ruminant animals in the drier parts of Bauchi State as a mitigation to Farmer-Herder crises in Nigeria. The study was conducted using 16 growing Yankasa rams with an average weight of 17-16kg. Nutrient intake and growth performance were evaluated. The grass was chopped and fed *ad libitum* as basal diets with proteins and energy concentrates as supplements at different combinations designated as diets 1, 2, 3 and 4 respectively. The experiment was conducted in a completely randomized design (CRD) with each treatment having 4 animals. The basal diet and water were offered *ad libitum* while the concentrate diets were fed twice daily at the rate of 150g morning and afternoon each. Results show the basal diet intake (871.70-930.72g/day), total feed intake (1167.57-1219.85g/day), dry matter intake (1095.73-1221.00g/day) were not significant ( $p>0.005$ ). However, supplement intake (g/day) was significant ( $p<0.005$ ) among the rams. Diet 4 recorded the highest intake value (295.87g/day) and the least value of (282.53g/day) was obtained from diet 2. However, the intake of crude proteins (113.06 and 109.46g/day) was significantly ( $p<0.005$ ) high for diet 1, and the lowest value (93.10g/day) was recorded for diet 2. Rams fed diet 4 recorded the highest final weights and average daily gain (ADG) of 23.50kg and 69.0g/day respectively while those on diet 1 had the least value (21.50kg and 65.2g/day). It was concluded that, feeding rams Napier grass supplemented with groundnut cake and maize bran concentrates gave better growth performance. Thus, feeding growing Yankasa rams chopped Napier diet, especially during the dry periods, along with 300g of groundnut cake and maize bran concentrates will go a long way to mitigate open grazing and Farmer-Herder conflicts in the study area, which is known for limited pasture and water sources, and in northern Nigeria generally.

**Keywords:** Growing, Yankasa, Rams, Napier, Grass, Supplements

### INTRODUCTION

Resource-based conflicts between Pastoralists and Farmers have become a major source of concern in Nigeria. In the first quarter of 2014, 16 separate violent conflicts in Plateau, Kaduna, Benue and Taraba States claimed 139 lives and left scores of people injured in the affected communities (NSRP, 2015). The incessant conflict has also taken its toll on livelihoods of both Pastoralists and Farmers as loss of livestock and interruptions of farming activities contribute to a reduction in income in the affected areas. The root causes of the persistent conflict lie in the paucity of pasture and water. The impact of Climate change in the form of desertification, declining water points and loss of foliage coupled with increasing human and livestock populations, which has intensified competition over scarce land and water resources, had exacerbated relationships between both groups. The jostle for grazing land and watering points for livestock, against farmlands and irrigation sources for crops has caused immeasurable human and material losses that demand urgent attention (NSRP, 2015).

With decreasing grassland area for open grazing and the spiraling Farmer-Herder violence as well as rising demand for animal products, the use of the remaining land for cultivation of Napier grass (*Pennisetum purpureum*) for use in stall feeding and range system may be the best option to curb the violence and increase animal production in northern Nigeria. Napier grass, also known as Elephant grass has been a promising and high yield grass, giving dry matter yield that surpasses most other tropical grasses, like guinea grass (*Panicum maximum*) and Rhodes grass (*Chloris gayana*) (Sarwanto *et al.*, 2019) and higher nutritive value compared to *Brachiaria* sp and *Panicum* sp, (Sarwanto *et al.* 2017). Historically, the grass has been primarily used as animal feed, however, it has also been used to



control weeds (Hanim and Muhlisin 2017), as mulch for erosion control (Adekalu *et al* 2007), source of bio-fuel (Sarwanto *et al.*, 2019), for making thatch, windbreak and as trap plant in the management of African stem borer (Sarwanto *et al.*, 2019). Elephant grass can be propagated through seeds, however as seed production is difficult, it is better to be propagated vegetatively by stem cuttings (stolons). After planting, elephant grass grows vigorously and can reach 4 meters in 3 months (Skerman and Riveros 1990).

Napier grass is a high-yielding fodder crop widely used in tropical and subtropical regions. Effective management strategies are essential to optimize its productivity, nutritive value, and overall contribution to livestock farming. It is one of the most important tropical forage crops. It is widely used in cut and carry feeding systems (Ngitung *et al.*, 2013) and is of growing importance in other agricultural systems. The grass possesses many desirable characteristics, including high yield per unit area, tolerance to intermittent drought and high temperatures and has water use efficiency (Sirait, 2017), making it a forage of choice in drier African regions. It has the ability to withstand repeated cutting and will rapidly regenerate, producing palatable leafy shoots (Sarwanto and Tuswati, 2018). Consequently, enhancing the knowledge-based use and conservation of the grass promises to substantially benefit livestock value chains (Ngitung *et al.*, 2013). Due to the fact that most smallholder livestock producers predominantly own small and fragmented pieces of land, grasses such as Napier grass offer a best-fit alternative to other feed options, as these are high yielding forages which require a minimum amount of inputs and acreage.

Napier grass also possesses a number of attributes including; high biomass yield (Sarwanto, *et al.*, 2017); rapid re-growth potential and ease of propagation (Ngitung *et al.*, 2013); attributes that help with the control of soil erosion; resistance to a broad spectrum of pests and diseases and suitability for cellulosic biofuel production (Taiwo *et al.*, 2025). The growth rate and biomass production of Napier grass surpasses other tropical grasses including Johnson grass (*Sorghum halepense*), switchgrass (*Panicum virgatum*), maize (*Zea mays*) and sugarcane (*Saccharum officinarum*). In addition, Sarwanto and Tuswati (2018) by following best management practices such as; regular cutting at between 60 to 90 days and keeping soil moisture level at an optimum level as well as applying fertilizer when required, the grass can be maintained for decades (Sarwanto *et al.*, 2019). However, the adoption and utilization of Napier as an alternative forage crop has not been totally successful due to the limited research and attention given to the pasture crop especially in sub-tropical environments (Sirait, 2017).

## **MATERIALS AND METHODS**

### **Study Area**

The study was conducted at the Teaching and Research Farm of Sa'adu Zungur University, Bauchi Bauchi State. The study area is located at latitude 11°52'0" N and longitude 9°58'0" E, at an altitude of 369 meters above sea level. The average annual rainfall is approximately 1091 mm. The climate consists of two distinct seasons; the rainy season (April to October) and the dry season (October to April). The hottest months are between March and May, with temperatures exceeding 101°F, while the coldest months are December and January, with temperatures ranging between 57°F and 90°F (Ananyous, 2026)

### **Propagation and Processing of Napier Grass for the Experiments**

Napier grass cuttings were sourced from Bauchi State Agricultural Development Program (BSADP). The Plant was cut with at least four nodes, ensuring two nodes are buried in the soil to form roots and two are exposed to form shoots. Spacing of 75 cm between rows and 50 cm between plants was adopted. Farmyard manure was applied before planting followed by urea fertilizer after 30 days of planting. The grass was harvested within 4 months after planting when the crop has developed a strong root and vegetative system. The grass was then harvested continuously without growth slowing down and it was freshly chopped to about of 3-5cm using hand chopper and fed to the experimental animals daily.

### **Experimental Diets and Animals**

Supplemental feed ingredients include cotton seed cake (CSC), groundnut cake (GNC), Wheat offal (WO), maize offal (MO) were obtained from different markets within the study area. CSC was



shredded to small sizes suitable for feeding small ruminants. The animals were randomly divided into four groups of four animals each and kept in individual pen, which was washed and disinfected with Izal solution. The pens have concrete floors and were well ventilated with space of about 1.5m<sup>2</sup> each. The animals were allowed 14 days period for adaptation to confinement.

Feeding of the supplement diets was done every morning and evening at about 0900 and 1600hrs at approximately 10% in excess of individual consumption. Animals were provided fresh drinking water in graduated plastic buckets. Total feed intakes of each animal were determined. The pens and feeding/water containers were cleaned daily. The animals were dewormed and weighed at the beginning of the experiment and weekly thereafter. The experiment lasted for 10 weeks 84 days including the 14 days period for adaptation.

The basal diet was offered *ad libitum* while 300g of the supplements was offered per head per day (twice every day, 9.00 am and 4.00pm). Animals were provided fresh drinking water. The total daily allocation of the diets was adjusted on the basis of the previous day's intake. Total basal and supplementary feeds intake of each animal were determined.

#### **Composition of the Basal and Concentrate Diets**

The chemical composition of basal and concentrate supplements are presented in tables 1 and 2 below.

**Table 1:** Chemical Composition of Basal Diets Fed to the Animals

Nutrients	Concentrate supplements			Basal diet	
	1	2	3	4	
Dry matter	92.8	93.00	92.60	92.60	94.00
Organic matter	94.00	93.60	92.50	92.60	82.00
Ash	00	00	00	00	00
Crude protein	17.50	13.60	22.10	21.60	11.20
Neutral Detergent Fibre	49.00	46.00	36.80	30.50	86.50
Acid Detergent Fibre	27.00	15.00	26.60	29.60	64.00
Hemicellulose	24.50	36.70	21.80	17.40	19.70

**Source:** Association of Analytical Chemists (1999)

**Table 2:** Composition of Supplements Fed to the Animals (Grams per Day)

Treatments/Diet	Ingredients				Total (g)
	CSC	GNC	WO	MB	
1 (CSC/WO)	150.00	0.00	150.00	0.00	300.00
2 (CSC/MB)	150.00	0.00	0.00	150.00	300.00
3 (GNC/WO)	0.00	150.00	150.00	0.00	300.00
4 (GNC/MB)	0.00	150.00	0.00	150.00	300.00

CSC=Cotton Seed Cake; GNC=Groundnuts Cake; WO=Wheat Offal; MB=Maize Bran; Diet 1= (Cotton Seed Cake/Wheat Offal), Diet 2= (Cotton Seed Cake/Maize Bran), Diet 3= (Groundnut Cake/Wheat Offal) and Diet 4= (Groundnut Cake/Maize Bran).

#### **Data Collection**

Data were collected on the following parameters:

##### **Feed intake**

Feed intake was determined by subtracting the feed left over from the original quantity provided on daily basis.

##### **Weight measurements**

Individual animals were weighed at the beginning of the trial to obtain **initial body weights** (IBW kg), and thereafter on weekly basis in the morning around 8:00 am, before fresh feeds were offered to them using a very sensitive weighing scale. **Feed conversion ratio** (FCR) was calculated using feed intake and body weight gain. Nutrient intakes (NI) were obtained from feed intake and chemical composition of the feed materials.

## RESULTS

### Nutrient Intake of Animals Fed the Experimental Diets

Nutrient intake of Yankasa rams fed basal diet of Napier grass supplemented with different combinations of protein and energy sources is presented in Table 3. The result shows a significant ( $P < 0.05$ ) difference in the supplement intake (SI g/day) across the treatments. Rams on treatment 4 recorded the highest value (295.87g/day), followed by treatment 3 (GNC/WO) and the least is 2 (282.53g/day). Basal feed intake (BFI g/day) was not significantly ( $P < 0.05$ ) different among the treatments. The value of the BFI ranged from 871.70g/day for animals on treatment 4 to 930.72g/day for those on treatment 1. Similarly, No significant ( $P < 0.05$ ) differences were recorded for total feed intake (TFI g/day). Significant differences were however observed for dry matter intake (DMI g/day) across the treatments. No significant differences are observed on Organic matter (OM g/day) intake but significant ( $P < 0.05$ ) difference was observed across the treatments for crude protein intake (CPI g/day), where animals on diet 3 (GNC/WO) and 1 (CSC/MB) consumed more protein (113.06 and 109.46 g/day, respectively) than others.

**Table 3:** Nutrient Intake of Growing Yankasa Rams Fed Experimental Diets

Parameters	Treatment				SEM	LOS
	1	2	3	4		
BFI(g/day)	930.72	930.45	873.21	871.70	18.44	NS
SFI(g/day)	289.13 <sup>b</sup>	282.53 <sup>c</sup>	294.31 <sup>ab</sup>	295.87 <sup>a</sup>	1.13	***
TFI(g/day)	1219.85	1212.98	1167.52	1167.57	17.78	NS
CPI(g/day)	109.46 <sup>ab</sup>	93.10 <sup>c</sup>	113.06 <sup>a</sup>	100.12 <sup>b</sup>	1.77	***
OMI(g/day)	985.40 <sup>ab</sup>	904.40 <sup>b</sup>	937.24 <sup>ab</sup>	1011.93 <sup>a</sup>	15.23	NS
DMI(g/day)	1173.99 <sup>b</sup>	1151.20 <sup>b</sup>	1095.73 <sup>c</sup>	1221.00 <sup>a</sup>	18.11	***

### Performance of Growing Yankasa Rams Fed Experimental Diets

Growth performance of growing Yankasa rams fed Napier grass with different combinations of proteins and energy sources are shown in Table 4. Final weight gain (FW/kg) was significantly ( $P < 0.05$ ) higher (23.50 kg) for animals on higher energy diets, treatments 4 (GNC/MB) and 3 (GNC/WO) compared with low energy diet 1 (CSC/WO). The results showed no significant differences ( $P > 0.05$ ) in weight change (kg) of the animals across the treatments. The highest and lowest values (7.00 and 5.0 kg) were obtained for treatment 4 and for treatments 1. However, significant ( $P < 0.05$ ) differences were observed in the average daily weight gain (ADG g/day) across treatments. ADG value (69.00g/day) for animals on diet 4 (1GNC/MB) was significantly ( $P < 0.05$ ) higher than those on the other diets, and the lowest (65.20 g/day) was recorded for diets that contain the same ratios of the two proteins and energy sources (CSC/WO and CSC/MB). The results of feed conversion showed no significant ( $P > 0.05$ ) differences among the experimental animals.

**Table 4:** Performance of Yankasa Rams Fed Experimental Diets

Parameters	Treatment				SEM	LOS
	1	2	3	4		
IW (kg)	17.5	15.8	16.0	16.5	0.01	NS
FW(kg)	21.5	22.0	22.7	23.5	4.78	**
WC(kg)	5.0	6.2	6.7	7.0	0.78	NS
FCR	16.0	13.45	15.8	14.4	2.2	NS
ADW (g/day)	65.2 <sup>b</sup>	65.3 <sup>b</sup>	68.9 <sup>a</sup>	69.0 <sup>a</sup>	8.03	**

<sup>abc</sup>= means on the same row having different superscript differ significantly; IW= initial weight; FW=final weight; WC= weight changes; FCR= feed conversion ratio; ADW= average daily weight gain

## DISCUSSION

The mean Basal diet intake (BFIg/day) in the current study (930.72-871.70g/day) was slightly lower compared to the values (1052g/day) reported by Tefere *et al.* (2014) for growing Begait sheep at an average weight of 29.2kg±2.79 fed urea treated Sesame straw diet supplemented with



sesame seed cake and wheat bran, at a ratio of 184g:87g. The differences in the BFIg/day of the current study and the one by Tefere *et al.* (2014) might be as a result of palatability and the nutrient value of Sesame seed cake compared to GNC and CSC used in the current study.

The higher BFIg/day obtained in diet 1 (CSC/WO) compared with the lower values recorded for diet 4 (GNC/MB) though having similar composition of supplements, could be attributed to the high level of maize bran in the diet, which gave more energy to microbes for digesting the fiber of the grass in the basal diet. The Napier grass intake of 871.70 to 930.72g/day recorded in the current study was higher than 389.50 to 463.19 g/day reported by Jokthan *et al.* (2013) for Yankasa sheep fed maize husk basal diets, but fall within the range (763-1052g/d) reported by Tefferi *et al.* (2014) who fed urea treated Sesame straw to male growing Begait sheep. The results of supplement intake (SIg/day) was significantly ( $P>0.05$ ) different and contrary to that obtained for BFIg/day. Rams fed diets that have the highest proportion of maize offal consumed more concentrates with the increasing level of maize offal. A high energy to low protein supplement appeared to be more appropriate than high or equal protein diets.

A study by Pittroff (2006) revealed that protein requirements need not to be exceeded because excessive protein impairs performance as energy is required for its removal. The mean SIg/day which ranged from 289.13-295.87g/day is slightly higher than (271g/day) postulated by Tefere *et al.* (2014), but lower than that (311.54-342.92g/day) recorded by Jockthan (2013) for Yankasa Rams fed cotton seed cake supplement. The differences may be attributed to age of the animals and experimental diets used in the experiments.

The linear increase in supplement intake with GNC based diets as protein supplement is in line with the report of Matinja *et al.* (2025) that cotton seed cake supplementation increases intake. Several reports by Ajayi *et al.* (2005) and Taiwo *et al.* (2025) also indicated that feed intake is an important factor in the utilization of feed by animals and is also a critical determinant of protein and energy availability as well as performance in livestock. The results of this experiment indicated an increase in feed intake with the increasing level of maize bran combined with groundnut cake, though treatment 1(CSC/WO) had the highest mean value of feed intake compared with treatment 3 (GNC/WO) but not significantly different.

Variation in feed intake between treatments 1 and 3 could be as a result of individual differences among the experimental animals (matinja et al., 2025) . All the experimental animals had adequate total dry matter (g/day) intake with values of 1221.00 and 1095.73g/day for animals on diets 4 and 3, respectively. Thus, Rams that received GNC and MB with maize bran at the higher percentage had the highest basal diet and DM intake while animals fed diet 1 (GNC/WO) had lower values. These values, though not significantly different, were comparable to range (959.95-1564.14g/day) reported for Yankasa sheep fed varying proportions of *Ficus polita* and pedicellitum supplemented with wheat offal (Abubakar *et al.*, 2015).

Furthermore, it was observed that the highest level of OM intake was obtained in treatment 4. This suggests that GNC/MB are acceptable and palatable concentrates for feeding Napier grass, probably due to a good balance between protein and energy in the diet. The results of the organic matter intake agrees with the reports of Teferi *et al.* (2015) who observed a range of 839 to 1214 g/day for male Begait sheep fed urea treated sesame straw. Daily organic matter intake in g/day (OMI) values 1011.93, 985.14, 952.79, 937.24, 911.85 and 904.40g/day were obtained for animals fed diets 4 (GNC/MB), 1 (CSC/WO), 3 (GNC/MB) and 2 (CSC/MB), respectively indicating that the NDF intake followed a similar trend as the organic matter intake. Crude Protein intake was significantly different across the treatment. CP which ranged from 93.10-113.06g/days is in line with the values 89.42-129.16g/day recorded by Muhammad *et al.* (2016).

Ratios of proteins and energy demonstrated an effect on crude protein intakes of the animals. Thus, diet 3 and 1 rich in an equal ratio of GNC/WO and CSC/WO performed better in their crude protein intake. This finding is in agreement with Quala *et al.* (2011) that the activity of the rumen microbes is improved by nitrogen supplemented diets leading to improved nutrients intake. Also, the nutritional worth of GNC was highly comparable in term of nutrients intake, digestibility and growth (Tariq *et al.*, 2019).



The initial body weights of the rams were similar among treatments as it was planned. Napier grass with supplementation has induced a significant difference in the final weight of animals. Highest mean value obtained in treatment with the combination of GNC/MB with maize bran at higher proportion was observed in treatment with CSC and WO at equal rations. These values disagree with the work of Teferi (2014) which could be as a result variation in the initial weight of the animals used by the different studies. The ADG (g/day) mean values ranged between 69.00 to 65.2g/day. This value is appreciably higher than 46.14 to 47.5g/day postulated by Adegun and Aye (2013) in their work with West African Dwarf Rams fed *Moringa oleifera* and cotton seed cake as protein supplements for *Panicum maximum*. The result is similar with the findings of Muhammad *et al.* (2008) for sheep fed varying levels of rice milling waste.

Rams fed diet 4 had the highest mean value of ADG; this could be attributed to higher DMI, better FCR and total feed intake. This was expected due to the composition of diet 4, which shows different carbohydrate profile (Leandro da, 2015). The average daily gain of 67.1g/day obtained in this study was somewhat lower than the ADG values 67.4 g/day for Bergait sheep and 54.4g/day for Washara sheep fed urea treated sesame straw (Teferi, 2005). This comparison suggests that Napier grass has a comparable feeding value for sheep. Also, Adu and Brinkman (1981) reported ADG values of (78-183g) when they fed fattened sheep groundnut cake as concentrate with digitaria hay. Feed conversion ratio values which ranged from 16.0 to 13.45 are higher than the 7.38 to 7.93g/day reported by Adegun (2013) for West African Dwarf rams fed *Moringa Oleifera* and cotton seed cake as protein supplements to *Panicum maximum*, the observations recorded by Njidda *et al.* (2014) 0.51 to 0.72 for Yankasa rams fed *Ziziphus micromata* in a total mixed ratio.

FCR and ADG of the rams fed treatment diet in which GNC ratio was reduced compared to other diets indicate the superior feeding value of GNC and can be used as supplement in sheep diets with improved animal's performance.

## CONCLUSION AND RECOMMENDATION

Based on the findings of this study, it can be concluded that:

- i. It can be concluded that growing Yankasa rams can be fed Napier grass supplemented with 300g of groundnut cake and maize bran concentrates for better growth performance.
- ii. Livestock producers can incorporate Napier grass into small ruminants' feeds in order to reduce the cost of production, especially during the dry season and to mitigate against the problems of Farmer-Herder conflicts that are prevalent in the resource prone areas of Sahel savannah and in northern Nigeria generally.
- iii. It is also recommended that Livestock farmers need to establish Napier grass plot at the back of their farms, considering its low production cost, ease of maintenance, better growth performance potentials, and to ensure a sustainable and enduring source of fodder to their livestock.

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