



RESPONSE OF EARLY RAINY SEASON GRAZING YANKASA RAMS SUPPLEMENTED WITH GRADED LEVELS OF UREA AND/OR COTTON SEED CAKE

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ABSTRACT

The study was conducted to investigate the response of twentyyearly rainy season grazing *Yankasa* rams supplemented with dietary levels of cotton seed cake and urea. The supplementation was done to augment an unbalanced energy-to-protein ratio, with a relative excess of energy that exists in the tropical grasses under grazing during the rainy season. The treatment consisted of five experimental supplement of 16% CP each, formulated using maize offal, groundnut haulms, rice bran, bone meal, salt and graded levels of cotton seed cake (16.00, 12.00, 8.00, 4.00, and 0.00%) and urea (0.00, 0.50, 1.00, 1.50 and 2.00%) and laid out in a Completely Randomized Design (CRD). Daily supplementation of 400 g quantity was done twice (200 g), in the morning (07:00 hours) and afternoon (15:00 hours). Animals were taken out for grazing after each supplementation. The dry matter and nutrient intake, digestibility, growth performance and haemato-biochemical indices of grazing *Yankasa* rams were determined. Average daily feed intake of animals fed supplement 1 (392.47 g/day) was statistically ($P<0.05$) superior to only supplement 5 (282.28 g/day). Daily weight gains of animals fed supplement 1 (75.33 g) similar to those fed on supplement 2, 3 and 4 but was statistically ($P<0.05$) higher than those fed on supplement 5. Dry matter digestibility of diet 5 (32.65%) was statistically ($P<0.05$) lower than diet 1, 2, 3 and 4. Supplement 5 recorded the highest feed cost per kg gain (₦380.38), whereas supplements 4 recorded the least (₦286.66). Based on the result of these findings, supplement 4 can be recommended for early rainy season grazing *Yankasa* rams.

Keywords: *Yankasa*, Grazing, Urea, Cotton Seed Cake, Digestibility

INTRODUCTION

In Nigeria, like most tropical countries, sheep production is based on tropical grasses under grazing as the primary nutrient resource. However, tropical grasses are rarely considered to represent a balanced diet for grazing cattle, sheep and goat, as they exhibit one or more nutritional constraints, which may limit forage intake, digestibility, or the metabolizability of absorbed substrates. This will limit sheep production efficiency and reproductive performance (Paulino *et al.*, 2008). According to Khalil *et al.* (2016) grazing pasture is presumably able to fulfill fodder requirement for a greater population of breeding cattle (sheep and goat inclusive), whereas low reproductive rates are most likely caused by mineral deficiency in soil and grazing forages. Similarly, in the rainy season, tropical forages are not considered deficient in Crude Protein (CP). However, benefits of supplementation of grazing cattle with nitrogenous compounds in the rainy season have been reported (Zervoudakis *et al.*, 2008; Costa *et al.*, 2011 and Figueiras *et al.*, 2015). The effects of supplemental nitrogen in the rainy season, however, have been considered to be mainly metabolic when contrasted to the dry season, when the nitrogen has the main role of improving the microbial activity in the rumen (Detmann *et al.*, 2014). Therefore, for grazing animals, and in order to avoid constraints on animal production, an appropriate supplementation program of nitrogen is paramount. However, the use of conventional feedstuffs such as maize, soybean, fish and others as supplement to low quality feed may not be cost effective in present day Nigeria to intensify production, owing to their high cost, irregular supply (Akinmutimi, 2004) and the competition both with humans and monogastrics (Adama, 2008; Ajayi *et al.*, 2008; Ukpabi and Abdu, 2009 and Gebregiorgis *et al.*, 2011).



Alternatively, unconventional energy and protein materials of farm and agro-industrial wastes origin are now being utilized for livestock production in Nigeria (Ndubueze *et al.*, 2006 and Okonkwo *et al.*, 2008). However, they are low in nitrogen and high in lignocelluloses (Arora and Sharma, 2009), which leads to low digestibility and low voluntary intake (Umar *et al.*, 2017). Consequently, the energy and nitrogen intakes of animals raised on these feeds cannot maintain adequate levels of performance. All these lead to low growth, poor reproductive performance and low milk yield (Abubakar, 2008 and Umar *et al.*, 2017). Therefore, such alternatives should be cheap, have high nutritive value, non-toxic, readily available, have low or no demand by both human and other livestock species, and with little or no industrial usage (Egbo *et al.*, 2001; Amaefule, 2002 and Ndubueze *et al.*, 2006). Hence, the choice of urea and cotton seed cake for this research. The specific objective is to determine the effects of supplementing of early rainy season grazing with graded levels of urea and/or cotton seed cake on nutrient intake, digestibility, growth performance, haemato-biochemical indices and production economy of *Yankasa* rams.

MATERIALS AND METHODS

Study Area

The study was conducted at Abubakar Tafawa Balewa University (ATBU) Teaching and Research farm Bauchi, Nigeria. Bauchi is strategically located between latitude 9.3⁰ and 12.3⁰ north of the equator. Longitudinally the state lies between longitudes 8.5⁰ and 11⁰ east of the Greenwich meridian (BSG, 2009) and its vegetation zone is Sudan Savannah. Bauchi has a rainfall regime of 1,300 mm per annum, which starts in the month of April and ends in the month of October (BASGD, 2006).

Experimental Animals and their Management

Twenty (20) grower *Yankasa* rams of about 8-9 months old and weighing averagely 16.09 kg were purchased. Prior to their purchase and subsequent arrival, the house was cleaned and disinfected with disinfectants. On arrival, the animals were weighed, identified using ear tags, fed, and quarantined for two weeks, during which, they were treated with a broad-spectrum anthelmintic (Albendazole) against worms. They were also vaccinated against Petes des Petits Ruminantes (PPR) and external parasites (Ivomestin) administered, subcutaneously. During quarantine, animals were fed groundnut haulms and guinea corn bran and provided with clean water *ad libitum*. The animals were randomly divided into five groups of four animals each and kept in individual pens of 2.5 M X 2.0 M space in a Completely Randomized Design (Steel and Torrie, 1980).

Experimental Supplements and Animal Feeding

Five (5) experimental supplements (16% CP) each were formulated using maize offal, groundnut haulms, rice bran, bone meal, salt and graded levels of cotton seed cake (16.00, 12.00, 8.00, 4.00, and 0.00%) and urea (0.00, 0.50, 1.00, 1.50 and 2.00%) for treatments 1, 2, 3, 4 and 5 respectively. The experimental animals were allowed 14 days of adaptation period to adjust to the supplements and confinement. Daily Feeding of supplements of 400 g quantity was done twice (each 200 g), in the morning (07:00 hours) and afternoon (15:00 hours). Animals were taken out for grazing after each supplementation. Clean drinking water was provided *ad libitum*. The supplements consumption level of each animal was taken, on daily basis. It was done by subtracting the quantity of the leftover from the quantity of the feed served. The experiment lasted for 90 days. The ingredients composition of the experimental supplements was shown in Table 1.

Growth Performance Evaluation

The Initial Body Weight (IBW) of individual animal was measured at the beginning of the trial, and subsequently, on weekly basis. All measurement was done in the morning, before feed was served to the animals, using a very sensitive weighing scale.

Also, the Daily Weight Change, DWC was determined by measuring the initial and final body weights of the animals. The difference between the two (initial and final body) weights was divided by the time frame. The Feed Conversion Ratio, FCR was computed using separation of weight gain from feed intake.



Table 1: Ingredient Composition of the Experimental Supplementary Fed to the Animals (16% CP).

Ingredient (%)	Treatment (Diet)				
	1	2	3	4	5
Maize offal	50.64	54.00	57.38	60.52	63.81
G/nut haulms	10.86	11.00	11.12	11.48	11.69
Cotton seed cake	16.00	12.00	8.00	4.00	0.00
Urea	0.00	0.50	1.00	1.50	2.00
Rice bran	20.00	20.00	20.00	20.00	20.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Salt	0.50	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00	100.00

Nutrient Digestibility Study

At the end of the experiment, digestibility study was conducted. Three animals per treatment were selected randomly from each for digestibility study. Each animal was taken into metabolic cage for faecal collection. Treatment for each animal was maintained. The animals were allowed 7-day adjustment period before faecal collection was done. The faecal collection was done for 7 days. The faeces excreted by each animal were collected daily, in polythene bags, and weighed and then oven-dried at 60 - 65°C for 24 hours. The oven-dried faeces of each particular animal for 7 days were filled together and mixed thoroughly, and fraction (10%) was taken for chemical analysis and nitrogen analysis. The digestibility was determined using mathematical relationship, as thus:

$$\% \text{ Digestibility} = \frac{\text{Total nutrient intake} - \text{Total nutrient excreted}}{\text{Total nutrient intake}} \times 100$$

Chemical Analysis

Chemical composition of the experimental diets was determined as described by AOAC (2005).

Statistical Analysis

The data collected were analyzed by ANOVA using the General Linear Model of SAS package (2016) and means was compared using the new Duncan Multiple Range Test (2000).

RESULTS AND DISCUSSIONS

DRY MATTER AND NUTRIENT INTAKE

DAILY SUPPLEMENT INTAKE

The average Daily Feed Intake (DFI) of *Yankasa* rams fed supplements 1, 2, 3 and 4 were similar and supplement 5 was inferior to only supplement 1. This could be attributed dietary level of urea at 2.0% rate and other ingredients did not form a suitable combination for animal nutrition.

SUPPLEMENT DRY MATTER INTAKE

Dry Matter Intake (DMI) of supplements 1, 2, 3 and 4 are the same, but only supplement 1 is superior to supplement 5. It was observed that the dry matter intakes have non-significant decrease with introduction of urea in supplements 2, 3 and 4 at 0.5, 1.0 and 1.5 levels, respectively, as compared to that of supplement 1 (feed with zero urea). However, with 2.0 percent level of dietary urea, a further decrease in feed intake was observed, leading to a significant ($P < 0.05$) depression in feed intake as compared to supplement 1. The dry matter intakes in *Yankasa* rams remained nearly constant up to 1.5 percent dietary urea level. However, beyond this level, the intakes were adversely affected. Urea can limit the voluntary intake of a feed in which it is contained. The effect of increased urea proportion in dry matter intake has been variable as some workers observed a depression in intake (Forero *et al.*, 1980 and Koster *et al.*, 1997), whereas others have reported an increase or no effect (Koster *et al.*, 2002). Higher levels of urea tended to affect the palatability of ration as reported by Koster *et al.* (2002) in lactating cows.

Additionally, Wang *et al.* (2016) reported that when urea was supplemented at up to 25 g/kg DM, the DMI was reduced in *Dorper* crossbred sheep. In present research, it was observed that urea at 2.0 level of inclusion has adverse effect. The dry matter intake reduced significantly at 2.0 level of urea inclusion. Ho Quang *et al.* (1999) also reported that increasing of urea in the feed decreases the intake.



Supplement Organic Matter Intake

The organic matter intake of supplements 1, 2, 3 and 4 were the same but supplement 5 (210.72g/day) was inferior to only supplement 1 (278.05 g/day). That was because supplement 1 and 5 had organic matter contents of 79.46% and 82.56% and dry matter intake of supplement 1 (349.93 g/day) was higher than supplement 5 (255.24 g/day) respectively. Organic matter intake is the percentage of organic matter content in dry matter intake. It is also defined as the difference between dry matter and inorganic matter (minerals) contents of food (Muhammad *et al.*, 2008). The more the dry matter intake the more the organic matter intake of food, provided organic matter content of that food remains constant.

SUPPLEMENT CRUDE PROTEIN INTAKE (SCPI)

The Crude protein intake of supplements 1, 2, 3, 4 and 5 are the same. The crude protein intake in this study (57.25 - 42.57 g/day) was lower than 109 g/day reported by Hirut *et al.* (2011). This is because the CPI in this study is for supplementation while that of Hirut *et al.* (2011) was a complete diet in a recommended quantity.

Supplement Neutral Detergent Fibre Intake (SNDFI)

The Neutral detergent intake of supplements 1, 2, 3, 4 and 5 are the same. That ranged from 141.93 g/day to 119.20 g/day and was lower than the range (315.37 – 393.70 g/day) recorded by Aime *et al.* (1999).

SUPPLEMENT ACID DETERGENT FIBRE INTAKE (SADFI)

The Acid detergent intake of supplements 1, 2, 3, 4 and 5 are the same. The ADFI ranged from 109.88 g/day to 93.72 g/day was lower than the range (305.00 – 323.00 g/day) recorded by Hirut *et al.* (2011).

Growth Performance of Animals Fed the Experimental Supplements

INITIAL BODY WEIGHT

There was no difference in initial weight between animals fed supplements 1, 2, 3, 4 and 5. Hence, they were the same.

Table 2: Dry Matter and Nutrient Intake of *Yankasa* Rams Fed the Experimental Supplements.

Parameter	Treatment					SEM
	1	2	3	4	5	
Average Daily Suppl. Intake (g)	392.47 ^a	326.81 ^{ab}	328.04 ^{ab}	329.59 ^{ab}	282.28 ^b	13.70*
Suppl. Dry Matter Intake (g/day)	349.93 ^a	291.68 ^{ab}	292.97 ^{ab}	295.48 ^{ab}	255.24 ^b	12.13*
Suppl. Organic Matter Intake (g/day).	278.05 ^a	229.05 ^{ab}	235.49 ^{ab}	240.64 ^{ab}	210.72 ^b	9.37*
Suppl. Crude Protein Intake (g/day)	57.25	46.35	48.08	49.2	42.57	1.46 ^{NS}
Suppl. Neutral Detergent Intake (g/day)	141.93	121.43	132.25	136.66	119.2	4.46 ^{NS}
Suppl. Acid Detergent Intake (g/day)	109.88	95.47	100.23	104.33	93.72	1.19 ^{NS}

^{a,b} - means with different superscript along the same row are significantly different, * (P<0.05), SEM- Standard error of means, NS- Non-significant, Suppl.- Supplement, 1- Cotton seed cake (16%) + Maize offal + Groundnut haulm + Rice bran, 2- Cotton seed cake (12%) + Urea (0.5%) + Maize offal + Groundnut haulm + rice bran, 3- Cotton seed cake (8%) + urea (1.0%) + maize offal + groundnut haulm + Rice bran, 4- Cotton seed cake (4%) + Urea (1.5%) + Maize offal + Groundnut haulm + Rice bran, 5 – Urea (2.0) + Maize offal + Groundnut haulms + Rice bran.

Table 3: Growth Performance of *Yankasa* Rams Fed the Experimental Supplements.

Parameter	Treatment					SEM
	1	2	3	4	5	
Initial Weight (kg)	14.60	16.00	15.80	17.50	16.53	0.54 ^{NS}
Final Weight (kg)	21.38 ^{ab}	21.05 ^{ab}	20.37 ^{ab}	22.20 ^a	19.78 ^b	0.66 [*]
Total Weight Gain (kg)	6.78 ^a	5.05 ^b	4.57 ^b	4.70 ^b	3.25 ^c	0.40 [*]
Suppl. Dry Matter Intake (g/day)	349.93 ^a	291.68 ^{ab}	292.97 ^{ab}	295.48 ^{ab}	255.24 ^b	12.13 [*]
Daily Weight Gain (g)	75.33 ^a	56.11 ^{ab}	50.77 ^{ab}	52.22 ^{ab}	36.11 ^b	4.46 [*]
Suppl. Feed Conversion Ratio	4.64 ^c	5.20 ^b	5.77 ^b	5.66 ^b	7.07 ^a	1.01 [*]

^{a,b,c}- means with different superscript along the same row are significantly different, * (P<0.05), SEM- Standard Error of Means, NS- Non-Significant, Suppl.- Supplement, 1- Cotton Seed Cake (16%) + Maize offal + Groundnut haulm + Rice bran, 2- Cotton Seed Cake (12%) + Urea (0.5%) + Maize offal + Groundnut haulm + rice bran, 3- Cotton Seed Cake (8%) + Urea (1.0%) + Maize offal + Groundnut haulm + Rice bran, 4- Cotton Seed Cake (4%) + Urea (1.5%) + Maize offal + Groundnut haulm + Rice bran, 5 – Urea (2.0) + Maize offal + Groundnut haulms + Rice bran.

Final Body Weight

There was significance difference between animals fed supplements 1, 2, 3, 4 and 5. Supplement 5 was lower than supplement 4 only. That was because the average initial body weight of animals fed supplement 4 (17.50 kg) was numerically higher than all other supplements.

TOTAL WEIGHT GAIN (TWG)

Total Weight Gain of animals fed supplements 1 was higher than supplement 2, 3 and 4 were the same; supplement 1 was superior to only supplement 5. That could be attributed to the fact that the Daily Matter Intake of supplement 1 (349.93 gday⁻¹) was higher than supplement 5 (255.24 gday⁻¹). Animal that consumes more than the average animals, gains more weight than the average animals.

AVERAGE DAILY WEIGHT GAIN (ADG)

The average daily weight gain of animals fed supplements 1, 2, 3 and 4, like in the case of the Total Weight Gain, are statistically similar, but supplement 5 was inferior to only supplement 1. This may be as a result of the crude protein intake of supplement 1 (57.25 gday⁻¹) was numerically higher and supplement 5 (42.57 gday⁻¹) (Table 3), even though they are statistically similar, they are numerically different. Proteins are the principal constituents of the animal body and continuously needed in the feed for growth and cell repair (Ensminger, 2002); as such, the more proteineous feed is, when feed upon, the more it builds the body. This is, because proteins are the building block of the body. According to the report of Cheeke (1999), protein is a critical nutrient, particularly for young rapidly growing animals and for maturing, lactating animals. According to Ma *et al.*, 2017, protein is one of the nutrients that affect lambs' growth and slaughter weight. Several studies reported that increasing crude protein (CP) levels resulted in increased average daily gain (ADG) (Haddad *et al.*, 2001; Santos *et al.*, 2015; Estrada-Angulo *et al.*, 2018; Kiran and Mutsvangwa (2009)), increased carcass weight (Estrada-Angulo *et al.*, 2018; Beauchemin *et al.*, 1995).

In another dimension, in one study, Wang *et al.* (2016) found that urea supplementation at up to 1.5 g/kg DM did not influence BW gain, but urea supplementation at 2.5 g/kg DM reduced the growth performance of Dorper crossbred sheep fed a diet with a 50:50 concentrate:forage ratio. The decreased animal growth might be explained as a result of disruption of the synchronization between carbohydrate and nitrogen due to a rapid increase in ammonia concentration in the rumen (Kertz, 2010). It is worthy to note that in the present study, including urea at 2.0 level did not only reduced growth rate but also resulted to mortality.

Ammonia can cause adverse effects ranging from depressed animal performance to death (Patra and Aschenbach, 2018). However, in contrast to this study and that of Wang *et al.* (2016), the work of Yixuan (2019), however, showed no negative influence on lamb growth performance when urea was fed at 30 g/kg DM. This discrepancy is probably due to the difference in the composition of the diets and/or sheep breed (Yixuan *et al.*, 2019). Thus, the optimal level of urea supplementation needs to be determined for the specific diet fed to the animals and breed of interest.



SUPPLEMENT FEED CONVERSION RATIO (FCR)

The feed conversion ratio was similar for all the supplements. Feed efficiency was an important index reflecting digestion and absorption efficiency of a given dietary (Zaman *et al.*, 2002).

NUTRIENT DIGESTIBILITY

Table 4: Nutrient Digestibility of the Experimental Supplements Fed to Grazing *Yankasa* Rams

Parameter	Treatment (%)					SEM
	1	2	3	4	5	
Dry matter digestibility	49.11 ^a	51.55 ^a	47.11 ^a	44.21 ^a	32.65 ^b	1.99 [*]
Organic Matter Digestibility	50.93 ^a	52.24 ^a	47.83 ^a	45.28 ^a	34.78 ^b	1.91 [*]
Crude protein digestibility	62.05 ^a	65.63 ^a	65.98 ^a	64.00 ^a	49.27 ^b	1.73 [*]
Neutral detergent fibre digestibility	53.45 ^a	54.86 ^a	49.1 ^a	45.66 ^{ab}	37.84 ^b	1.94 [*]
Acid detergent fibre digestibility	48.17 ^a	48.52 ^a	43.52 ^a	38.95 ^a	24.07 ^b	2.6 [*]

^{a,b} means with different superscript along the same row are significantly different, *(P<0.05), SEM- Standard Error of Means, 1- Cotton Seed Cake (16%) + Maize offal + Groundnut haulm + Rice bran, 2- Cotton Seed Cake (12%) + Urea (0.5%) + Maize offal + Groundnut haulm + rice bran, 3- Cotton Seed Cake (8%) + Urea (1.0%) + Maize offal + Groundnut haulm + Rice bran, 4- Cotton Seed Cake (4%) + Urea (1.5%) + Maize offal + Groundnut haulm + Rice bran, 5 – Urea (2.0) + Maize offal + Groundnut haulms + Rice bran.

Dry Matter Digestibility

The dry matter digestibility of this study ranges from 32.65 - 51.55%, which was lower than 68.3% reported by El-kholy *et al.* (2009) for sheep fed diet containing urea-treated corn silage and molasses.

ORGANIC MATTER DIGESTIBILITY

Organic matter digestibility (OMD) ranged from 34.78% to 52.24% recorded in animals fed experimental supplements in this study was lower than the OMD of 64% reported by Hirut *et Al.* (2011) when fed a basal diet of urea-treated maize stover supplemented with different levels of concentrate mixed to Haraghe highland sheep. El-kholy *et al.*, (2009) also reported a higher OMD of 73.75%.

CRUDE PROTEIN DIGESTIBILITY (CPD)

Crude protein digestibility ranged from 49.27% to 65.98% was higher than 46.21% reported by Aime *et al.*, (1999). However, a higher Crude protein digestibility of 71% was recorded in the work of Hirut *et al.* (2011). Similarly, El-kholy *et al.*, (2009) recorded a higher CPD of 72.87% than that recorded in this study.

Neutral Detergent Fibre Digestibility (NDFD)

Neutral detergent fibre digestibility of the study ranged from 37.84% to 54.86% was higher than the value (38.14%) reported by Aime *et al.*, (1999), except for supplement 5, which had value (37.84%).

Acid Detergent Fibre Digestibility (ADFD)

Acid detergent fibre digestibility of this study ranged from 24.07% to 48.52%, which was closely related to the value (47.42%) that was reported by Aime *et al.*, (1999).

CONCLUSION AND RECOMMENDATION

Since diets 2, 3, 4 and 5 are scientifically similar but diet 5 is inferior to diet 1 in supplement feed intake and daily weight gain, and on the other hand, diet 1 is scientifically the same with diets 2, 3, and 4 in nutrient digestibility, diet 1 (that contains 16.00 CSC and zero urea) could be recommended to supplement early rainy season grazing *Yankasa* rams.

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