



## PERFORMANCE AND HAEMATOLOGICAL INDICES OF BALAMI RAMS FED CATTLE URINE-ENSEILED SORGHUM STOVER AS SOURCE OF NON-PROTEIN NITROGEN

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### ABSTRACT

A 90-days feeding trial was conducted to evaluate the effect of replacing fertilizer grade urea with cattle urine in sorghum stover silage on the performance and haematological indices of Balami rams. Five diets were formulated. Diet 1 (control) contained sorghum stover ensiled with fertilizer grade urea (FGU) while diets 2, 3, 4 and 5 had 25, 50, 75 and 100% levels of cattle urine as replacement for FGU. Twenty (20) rams of the Balami breed were allotted to the five diets in replicates of four in a completely randomized design. Data on daily feed intake, weight gain and haematological indices were collected. Results showed no significant influence of cattle urine on daily feed intake. However, Daily weight gain was significantly ( $P < 0.05$ ) higher on T5 (128.11 g) and T4 (124.08 g) which were the same, than on other diets which also did not differ (101.67 – 103.65 g). Similarly, Rams fed T5 (34.53 kg) had higher ( $P < 0.05$ ) final weight than those on other diets which were the same (30.30 – 31.93 kg). Feed conversion ratio was significantly ( $P < 0.05$ ) better on T5 (5.74) and T4 (5.88) compared to T1 (7.19), T2 (7.13) and T3 (7.06) which were poorer. All haematological indices did not significantly differ among diets. It was therefore concluded that cattle urine can completely replace fertilizer grade urea as silage additive in sorghum stover and as non-protein nitrogen source in balami rams.

**Keywords:** Sorghum stover, Cattle urine, NPN, Performance, Haematology, Balami rams diets.

### INTRODUCTION

Nutrition has universally been recognized as the major constraint to livestock productivity especially in Nigeria and the Sub-Saharan Africa. During the wet season ruminants feed on natural grasses and legumes. However, as the season terminates, these succulent forages become scarce and animals are left at the mercy of dry, fibrous, less palatable, less digestible, and nutritionally-deficient crop residues (straws and stover). Fermentable energy and protein deficiencies in crop residues coupled with their low digestibility impair intake, ruminal functions, and general productivity of animals (Aruwayo *et al.*, 2018). Feed alone accounts for 60 – 80% of the total cost of livestock production (Wang *et al.*, 2022). Supplementary feed such as cereal grains, oil seed meals and their by-products which have the potential to provide all the required nutrients, especially energy and protein in the right quantities and proportions, is rather expensive and not within the reach of a poor farmer. This scenario has also been implicated in the ongoing conflicts between farmers and herders over grazing resources not only in Nigeria but across the entire West African countries (Bello and Abdullahi, 2021).

Therefore, one way of remedying this problem is to improve the feeding value/quality of our available feed resources (crop residues). This could be done by treating them with Non-Protein Nitrogen sources. These sources have the capacity to hydrolyse the physical/chemical



bonds of lignin, cellulose and hemicellulose present in crop residues thereby improving their nutritional capacity (He *et al.*, 2021). Non-Protein Nitrogen can also be used by ruminants to synthesize true protein. Rumen microorganisms synthesize protein from substances containing nitrogen to build up their cells and to satisfy some and sometimes all of the protein requirements of the host animal. It is in fact, the cheapest way of providing protein to ruminant animals. Similarly, according to Lardy and Bauer (2017) and Salami *et al.*, (2020), treatment with NPN can double or triple the crude protein content of crop residues and increase their digestibility up to 30% level.

Feed grade or fertilizer grade Urea (FGU) has been the conventional source of NPN used worldwide. It has also been used as a successful silage additive. However, its use in Yobe and Borno States have been strictly restricted due to security reasons. Alternative non-conventional sources such as poultry manure have been used as NPN sources for ruminants (Trujillo *et al.*, 2014 and Jamee *et al.*, 2019). Poultry manure has been the most popular non-conventional NPN source used in ruminants feeding and as silage additive (Washaya *et al.*, 2018 and ACES, 2020). An assay of its chemical composition revealed that poultry manure contains 15 – 38% crude protein, 11 – 52% crude fibre, 0.81 – 6.13% Calcium, 0.56 – 3.92% Phosphorus and 0.73 – 5.17% Potassium (Lanyasunya *et al.*, 2006; Ravindran *et al.*, 2017). The NPN in poultry manure is present in the form of rumen degradable uric acid which can be utilized by rumen microbes for protein synthesis (Hanim *et al.*, 2019).

Cattle urine has also been identified as a good source of NPN. According to Bristow *et al.* (1992), total nitrogen content in cattle urine ranges between 6.8 – 21.6g N per litre, out of which about 69% is present as urea. Cattle urine has also been reported to have some health benefits in humans which include; treatment for diabetes, high blood pressure, asthma, eczema and ulcer among others (Mahajan *et al.*, 2020). However, available literature on its utilization as silage additive is very much limited. The aim of this study was therefore to evaluate the use of cattle urine as silage additive and as a source of non-protein nitrogen for Balami rams.

## **MATERIALS AND METHODS**

The study was conducted at the Ruminant Livestock Farm, Federal Polytechnic, Damaturu. Damaturu is within the GPS location of Latitude: 11° 44' 49.1856" N and Longitude: 11° 57' 58.2912" E. Situated in the semi-arid region of Nigeria, the area is characterized by a tropical continental climate with a short-wet season (June – August) and a long dry season (October – May). The mean annual temperature varies from 14.4 to 43°C while the average annual rainfall is about 560mm. (Weather Spark, 2021).

### **Collection, and Processing of Sorghum Stover**

Dry sorghum stover was collected from the Arable Crop Farm, Department of Agric. Technology, Federal Polytechnic, Damaturu, Yobe State. The stover was crushed into 3cm particles using a locally fabricated stalk crusher equipped with 3cm size sieve.

### **Ensiling of Sorghum Stover and Preparation of Experimental Diets**

Five (5) experimental basal diets were formulated and designated as T1 (0% CU), T2 (25% CU), T3 (50% CU), T4 (75% CU) and T5 (100% CU) (Table 1). In preparing each diet, one hundred (100) kilograms of crushed stover was spread on a tarpaulin, sprayed with a solution containing FGU, FGU/CU or CU using a knapsack sprayer. After thorough mixing, the residue was packed and compressed manually in airtight hermetic bags and kept indoor to ferment for a period of 14 days. In T1, the stover was ensiled with Fertilizer grade urea solution (4 kg dissolved in 50 litres water), T2 with a solution containing 3 kg urea and 1 litre cattle urine, T3 with a solution of 2 kg urea and 2 litre CU, T4 with 1 kg urea and 3 litres CU while



T5 was treated with a solution of 4 litres CU. In addition to the basal diet (sorghum stover), a concentrate mix containing 30% crushed maize, 40% cotton seed cake, 25% wheat offal and 5% cowpea husk was also prepared.

**Table 1:** Composition of Experimental Diets and Levels of Concentrate Mix Fed to Balami Rams

Diet	Levels				
	T1	T2	T3	T4	T5
Sorghum stover	+100FGU/ 0% CU	+ 25% CU	+ 50% CU	+ 75% CU	+ 100% CU
Concentrate (%)	33	33	33	33	33

Note: CU = Cattle urine

### Feeding and Management of Experimental Animals

The animals were managed intensively in a well-ventilated pen and tattered at a distance of 2 metres from each other. Prior to commencement of the feeding trial, the rams were dewormed and treated against ectoparasites using Ivermectin® injection at 1ml/40kg and kept for 2 weeks in order to get acclimatized to their new environment. After the adaptation period, the animals were allotted to five basal (experimental) diets in replicates of four and fed at 2% body weight/head/day (BW/H/D), supplemented with a concentrate mix at 1% Body weight/head/day for a period of 90 days. Routine management practices were carried out to ensure that animals were in proper health condition. Clean drinking water was also provided *ad libitum*.

### Data Collection

At the beginning of the study, the rams were weighed individually to determine their initial weights, and on weekly basis, to determine weight change. Daily feed intake was obtained by determining the difference between feed offered and the left-over retrieved after a 24 hrs period. At the end of 90 days, ten samples of blood (2 from each replicate) were collected via the Jugular vein for haematological assay. The samples (5 ml per ram) were collected in properly labelled sterilized non-vacuum tubes containing EDTA as anticoagulant.

### Chemical Analysis

Analysis of blood samples for haematological indices was carried out according to the method used by Fafiolu *et al.* (2020).

### Data Analysis

Data generated were subjected to One Way Analysis of Variance (ANOVA) using IBM SPSS statistics 25 for windows (SPSS, 2017). Means were separated through the Duncan Multiple Range Test of the same software, at  $P < 0.05$  level of significance.

## RESULTS AND DISCUSSION

### Performance of Balami Rams Fed Cattle Urine-Ensiled Sorghum Stover

Results for performance of Balami rams fed cattle urine ensiled sorghum stover based diets are presented in Table 2. Except for daily weight gain, final weight, body weight change and feed conversion ratio, no significant effect ( $P > 0.05$ ) of cattle urine was observed on performance parameters. Initial weight of rams ranged between 20.76 – 23.00 kg and daily feed intake between 725.01 g (T3) and 738.67 g (T2). Daily feed intake of rams in this study is higher than 615.72 – 696.00 g/day reported by Tekliye *et al.* (2018) in Farta sheep (18.9±1.7 kg) fed urea-treated rice straw supplemented with graded levels of *Sesbania sesban* leaves. Daily weight gain was significantly ( $P < 0.05$ ) higher on T5 (128.11 g) and T4 (124.08 g) which

were the same, than on other diets which also did not differ (101.67 – 103.65 g). These values are higher than 66.67 – 98.33 g reported by Alli-Balogun *et al.* (2018) in Yankasa rams (22.50 kg) fed urea-treated *gamba* hay but comparable with 103.20 – 156.20g/day reported for local sheep (20.12 ± 0.05 kg) in Ethiopia (Tsafiyo *et al.*, 2021). Rams fed T5 (34.53 kg) had higher ( $P<0.05$ ) final weight than those on other diets which were the same (30.30 – 31.93 kg). Similarly, total weight gain was higher on T5 (11.53 kg) and T4 (11.47 kg) than on diets T2 (9.33 kg), T3 (9.24 kg) and T1 (9.15 kg) which did not differ. Total feed intake did not differ across all treatments while feed conversion ratio significantly ( $P<0.05$ ) improved on T5 (5.74) and T4 (5.88) compared to T (7.19), T2 (7.13) and T3 (7.06) which were poorer.

**Table 2:** Growth Performance of Balami Rams fed Cattle Urine-ensiled Sorghum Stover as Replacement for Fertilizer Grade Urea.

Index	Diet					SEM
	T1	T2	T3	T4	T5	
Initial body weight (kg)	22.36	20.97	21.18	20.76	23.00	1.07 <sup>NS</sup>
Daily feed intake (g)	731.08	738.67	725.01	729.62	735.37	28.30 <sup>NS</sup>
Daily weight gain (g)	101.67 <sup>b</sup>	103.65 <sup>b</sup>	102.68 <sup>b</sup>	124.08 <sup>a</sup>	128.11 <sup>a</sup>	7.31 <sup>*</sup>
Final body weight (kg)	31.51 <sup>b</sup>	30.30 <sup>b</sup>	30.42 <sup>b</sup>	31.93 <sup>b</sup>	34.53 <sup>a</sup>	0.72 <sup>*</sup>
Body weight change (kg)	9.15 <sup>b</sup>	9.33 <sup>b</sup>	9.24 <sup>b</sup>	11.17 <sup>a</sup>	11.53 <sup>a</sup>	0.64 <sup>*</sup>
Total feed intake (kg)	65.80	66.48	65.25	65.67	66.18	1.02 <sup>NS</sup>
Feed conversion ratio	7.19 <sup>b</sup>	7.13 <sup>b</sup>	7.06 <sup>b</sup>	5.88 <sup>a</sup>	5.74 <sup>a</sup>	0.09 <sup>*</sup>

a,b. = Means on the same row with different superscripts differ significantly. \* significant @  $P < 0.05$ , SEM = Standard Error of Mean, NS = Not significant.

### Haematological Indices

Haematological indices of balami rams fed feed grade urea/cattle urine treated sorghum stover are presented in Table 3. According to Sheikh *et al.* (2022), haematological parameters are useful indicators of the health status of an animal. All parameters did not differ significantly ( $P<0.05$ ) among diets. Haemoglobin concentration ranged between 11.96g/dl on T5 and 13.24g/dl on T3. Packed cell volume was between 32.17% (T5) and 36.08% (T2) while red blood cell count was from 9.55 ( $\times 10^6/\mu\text{l}$ ) (T1) to 10.32 ( $\times 10^6/\mu\text{l}$ ) (T2).

Similarly, as presented in Table 3, white blood cell count ranged between 7.56 and 8.03 ( $\times 10^3/\mu\text{l}$ ) in rams fed T5 and T3, respectively. Mean corpuscular haemoglobin was between the range of 11.69 pg (T2) and 13.28 pg (T3), MCV, from 32.63 fl (T5) to 35.04fl (T1) and MCHC, between 33.43 g/dl (T3) and 38.69 g/dl (T3). All values obtained in this study are within the range for normal and healthy sheep reported by RAR (2009) and Ahmadi-hamedani *et al.* (2016). This implies that the rams are neither dehydrated nor anaemic. Furthermore, cattle urine when used as additive in sorghum stover silage and as source of NPN does not constitute any threat to the health of balami rams.



**Table 3:** Haematological Indices of Balami Rams fed Cattle Urine-ensiled Sorghum Stover as Replacement for Fertilizer Grade Urea.

Index	Diet					SEM
	T1	T2	T3	T4	T5	
Haemoglobin (g/dl)	12.08	12.06	13.24	12.77	11.96	0.99
PCV (%)	33.46	36.08	34.22	34.09	32.17	1.34
RBC (x 10 <sup>6</sup> /μl)	9.55	10.32	9.97	10.21	9.86	0.74
WBC (x 10 <sup>3</sup> /μl)	7.94	7.47	8.03	7.73	7.56	0.36
MCH (pg)	12.65	11.69	13.28	12.51	12.13	0.68
MCV fl	35.04	34.96	34.32	33.39	32.63	2.07
MCHC (g/dl)	36.10	33.43	38.69	37.46	37.18	1.87

PCV = Packed Cell Volume, RBC = Red Blood Cell, WBC = White Blood Cell, MCH = Mean Corpuscular Haemoglobin, MCV = Mean Corpuscular Volume, MCHC = Mean Corpuscular Haemoglobin Concentration, SEM = Standard Error of Mean.

## CONCLUSION AND RECOMMENDATION

Based on the findings of this study, it was concluded that cattle urine can completely replace fertilizer grade urea in sorghum stover silage without compromising performance and haematological indices. Furthermore, cattle urine is a good source of non-protein nitrogen for balami rams feeding. Consequently, cattle urine (CU) is hereby recommended as silage additive in sorghum stover and as dietary source of NPN.

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