Growth and Blood Indices of Red Sokoto Goats Fed Ensiled Crop Residue Diets (Corn Cobs) treated with Poultry Litter

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Abstract: This research was carried out to check the performance of growing Red Sokoto bucks fed diets supplemented with urea and poultry litter. The experiment was carried out at the department of Agric Education, Nuhu Bamalli Polytechnic, Zaria using twelve males growing Red Sokoto bucks. The goats were treated with ivomectin (ivomec®) against internal and external parasites with and Tetracycline LA was administered to treat bacterial infections. The bucks were weighed, put in groups and randomly allocated to three dietary treatments, with four bucks per treatment with each buck serving as a replicate and each group was randomly assigned to one of the three dietary treatments respectively. The bucks in each treatment group were housed in pens made of concrete floors. Bucks were fed 3.5% experimental diets on weight basis. Experimental animals were allotted (n=3) diets T1, T2 and T3 consisting of control (T1) without urea and poultry litter, T2 contained urea and T3 contained poultry litter. The experiment lasted for 90 days. The initial weight gain of the bucks was not significantly ($P>0.05$) different in all the treatment groups. There was significant difference in the final weight, average daily weight gain and average daily feed intake of with poultry diet having the highest values (16.69g, 2133.33g, 35.55g and 417.34g). Albumin and Eosinophil was significantly different $P< 0.05$ and all other parameters were not significant. In conclusion, Growth performance of bucks fed diets were significantly different ($P<0.05$) in all the parameters except for the initial weight across the treatments. Hence, bucks feed diets with poultry-litter we found to perform best in all the parameters.

Keywords: Supplementation, Growth performance, Blood metabolites, Poultry-litter, Bucks

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1. INTRODUCTION

Strategies to ensure quality feedstuff for ruminant animals all through the year are continually innovated. In West Africa, one of the major problems ruminant animal production faces is seasonal change which affects availability and nutritional value of natural grasslands (Oduguwa *et al*., 2013) especially during dry season period. Poor-quality roughages comprise a huge part of the feed readily available and its consumption results to a low plane of nutrition with attendant low productivity of the country's indigenous animals (Inweh *et al*., 2021). Several innovative researches have emerged to enhance the growth and general performance of ruminants during this dry season. Among such is the biochemical treatment of crop residues. Corncob silage are treated biochemically to increase its quality due to its high concentration of energy, protein and some mineral elements (Achi *et al*., 2023). Researches have shown that Urea and poultry litters when used to treat different crop residues like maize straw,

rice milling waste, sorghum stover etc has improved feed intake and performance of livestock (Aruwayo *et al.*, 2022; Muhammad *et al.*, 2023). However, little or no research carried out to ascertain the growth performance of bucks fed diets and effect on blood metabolites. supplemented with urea ensiled corncobs and poultry litter ensiled corncobs. hence, this research was carried out to determine the performance of Red Sokoto bucks fed urea ensiled and poultry litter ensiled corncobs supplemented diets.

2. MATERIALS AND METHODS

Experimental site

The research was carried out at the Small Ruminant Unit of the Teaching and Research (T&R) Farm of the Nuhu Bamalli Polytechnic, Zaria, Kaduna State, Nigeria.

Experimental Diets

Table 1: Percentage composition of maize cobs silage diets fed to Red Sokoto goats

Parameter (%)	T1	T2	T3
Ensiled Maize cobs	45.00	45.00	45.00
Cowpea husk	16.60	16.60	16.60
Wheat bran	10.00	10.00	10.00
Maize bran	22.00	22.00	22.00
Cotton seed cake	5.00	5.00	5.00
Bone meal	0.60	0.60	0.60
Table salt	0.50	0.50	0.50
Premix	0.30	0.30	0.30
Total	**100.00**	**100.00**	**100.00**

T1 = Water treated ensiled maize cobs, T2 = Poultry manure treated ensiled maize cobs, T3 = Urea treated ensiled maize cobs

Experimental design, experimental animals and animal management

Completely randomized design was used for the whole research. Twelve (12) Red Sokoto bucks within 8 to 12 months of age (determined via dentition) with average weights of 12kg±0.25kg were used for the experiment. The bucks were purchased from Giwa market in Giwa Local Government Area Council, Kaduna state.

On arrival from the marky, the bucks were quarantined for two (2) weeks. They were treated against internal and external parasites using ivomectin (ivomec®) and also Tetracycline LA was administered against bacterial infections. The bucks were weighed, grouped and randomly allocated to three dietary treatments, with four bucks per treatment each buck served as a replicate and each group was randomly assigned to one of the three dietary treatments. The bucks in each treatment group were housed in pens made of concrete floors. Bucks were fed 3.5% experimental diets on weight basis, the feed offered was administered once at 8:00am daily and left over feed was measured and recorded. Fresh clean water was given *ad libitum* daily throughout the research. Experiment lasted for 90 days.

Measurements.

During the feed trail, the experimental diets were fed to the animals once in the morning at 2.5% body weight before Digitaria hay was provided daily. Record of feed offered and left over were taken daily to determine voluntary intake. Water and mineral salt licks were provided *ad libitum*. Forth nightly, the bucks were carefully weighed to determine live weight changes and adjust the feed offered.

Digestibility study

During the last 14 days of the study period, three animals from each treatment were selected for digestibility trial . They were

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transferred to the metabolic cage and faecal samples were collected. Twenty percent (20%) of the feacal samples were taken and oven-dried at 65^0C for three days for moisture content determination.

Digestibility of the nutrients was determined by the formula:

Dry matter digestibility = Feed intake (g/ dm) - Feacal output (g/ dm) x 1***00***Feed intake (g/dm)

% Nutrient digestibility = Nutri*ent in feed - Nutrient in feaces x* 1***00***
Nutrient in feed

Haematological studies

About 5 ml of blood (3mls for heamatology and 2mls serum analysis) were taken from the jugular vein of the animal at the were using needle and hyperdemic syringes (5mL), at two week intervals, at the onset, middle and end of the trial between 7:30 a.m to 8:30 am before feeding the animals. The blood samples for haematology and serum biochemical were placed in two separate vacuum tubes, one without anti-clotting agent for serum biochemistry analysis and the other with ethylene diamine tetra acetic acid (EDTA) for haematological analysis.

Immediately after collection, the capped tubes containing the anti-coagulant and blood sample were innervated gently about 10 times. Samples of blood were transported using ice box with ice park to the Microbiology laboratory of the department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria, for determination of haematological and serum biochemical parameters. In the laboratory, the haematological analysis was performed using a semi-automatic cell counter (Sysmex-F 820).

Through quality control and careful handling of the samples, the accuracy and reliability of the procedures, instruments and the reagents were ensured.

Chemical analysis

All the samples collected (silages, feeds, and faecal) were taken to Biotechnology Laboratory of the National Animal Production Research Institute, Ahmadu Bello University, Zaria, and subjected to chemical analysis. Crude protein, crude fibre, ether extract and ash of the silages were determined according to the methods of (AOAC, 2005). Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF) and Acid Detergent Lignin (ADL) were determined using the procedure of Van Soest *et al*. (1991).

3. RESULT AND DISCUSSION

Chemical composition of experimental feed

Chemical composition of supplementary diets of urea and poultry are presented in Table 1.The chemical composition for diet Treatment 1(T1), 2(T2) and 3(T3) is as follows: Crude protein 12.47% (T1), 9.24%(T2) and 7.26% (T3). Crude fibre 21.28% (T1), 22.93% (T2) and 21.46(T3), Ether Extract 7.85% (T1), 9.09% (T2) and 8.87 (T3), Ash 16.13% (T1),14.06% (T2) and 11.06% (T3) and dry matter 93.57% (T1), 91.82% (T2) and 94.06% respectively.

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Table 2: Chemical composition of supplementary diets containing urea and poultry

	Treatment		
Parameters	T1	T2	T3
Dry matter	93.57	91.82	94.06
Ash	16.13	14.06	11.60
Ether extract	7.85	9.09	8.87
Crude fibre	21.28	22.93	21.46
Crude protein	12.47	9.24	7.26

Growth performance of Red Sokoto bucks fed urea or poultry litter supplemented diet

Table 2 shows result of growth performance of Red sokoto bucks fed urea or poultry litter supplemented diet. There was no significan difference (P>0.05) in the initial weight gain of the bucks in all the treatment groups. Final weight, average daily weight gain and average daily feed intake of with poultry diet having the highest values (16.69g, 2133.33g, 35.55g and 417.34g) were significantly different. These values are followed by that of diet containing urea (T2) and the control group having the least.

The result on Table 3 is in agreement with report by Inweh *et al*., 2021 who fed sorghum stover to Yankasa rams and heifers and supplemented it with poultry droppings. Availability, age and size of the bucks and the season in the market during the procurement of the animals (Zagi *et al*., 2022) may be the reason for the non-significant effect recorded in the initial weight of all the animals. The high values of final weight, average daily weight gain and average daily feed intake of diet with poultry litter may be due to the high protein level of poultry litter and supplement feeding of concentrate may enhance degradation of more polysaccharides, hence, extra energy is generated for the host (Laursen *et al*., 2017). Fajemisin *et al*. 2012 reported that feed intake increased in livestock diets with low fiber content and adequate protein. The crude protein of the poultry litter in this study was 22.00%.Various authors have reported crude protein values for poultry litter 25% (Yousuf *et al*., 2013), 20% (Owen *et al*., 2008) and 23% (Saleh *et al*., 2003).

There was a similar trend in performance of bucks fed with T2 (diet with urea). This result agrees with report by Kolo *et al*. 2018 which suggested that West African Dwarf Goats performed well in terms of final weight gain, feed intake and average daily weight gain when fed Urea-fortified corncobs up to 3%.

Increase in fed intake is a very important factor that determines productivity in ruminants and Urea treatment in diets increases the acceptability and voluntary intake of treated crop residue as compared with to untreated crop residue when it is fed *ad libitum*. This increase in intake is very important because what and how much animals eat (their feed intakes) are the most important (Kayouli, 1996). Furthermore, Kayouli (1996) reported that the consumption of urea-treated forages during dry season lead to remarkable improvement in body condition of the animals and maintenance of live weight.

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Table 3: Growth performance of Red Sokoto bucks fed experimental diets

Parameters	Treatments T1	T2	T3	SEM	LS
Initial weight (kg)	14.58	14.56	14.59	0.074	NS
Final weight (kg)	15.27[c]	16.69[a]	16.23[b]	0.160	*
Weight gain (g)	686.67 [c]	2133.33 [a]	1643.33 [b]	61.644	*
Average daily weight gain (kg)	11.44 [c]	35.55 [a]	27.39 [b]	0.890	*
Average daily feed intake (g)	235.00 [c]	417.34 [a]	363.67 [b]	3.723	*
Feed conversion ratio	20.59 [c]	11.76 [a]	13.29 [b]	0.889	NA
Mortality	0.00	0.00	0.00	-	-

Means with different superscript on the same row are significantly different ($P < 0.05$). LS = level of significant, NA = not applicable, NS = not significant, * = significantly differed

Blood metabolites of Red Sokoto bucks fed urea or poultry manure treated ensiled corn cobs

Table 3 shows result of blood metabolites of Red Sokoto goats fed urea or poultry manure treated ensiled corncobs. Albumin and Eosinophil was significantly different $P< 0.05$ and all other parameters were not significant.

Blood is a good indicator to monitor the health of an organism (Joshi, 2002) and ingestion of various dietary components has been reported to have measurable effects on blood constituents of various animals (Arowora, 2003). Haemoglobin concentration (Hb) and red blood cell counts took a similar trend as in PCV and the values recorded across the treatments for Hb were higher than 5 – 6 g/dL reported by Belewu and Ogunsola (2010) but were within the range of 7 – 15 g/dL stated for WAD goats by Daramola (2005). Bello and Tsado (2013) reported RBC values ranging from 6.4 – 9.9 x10 /L when growing Yankassa rams were fed sorghum stover supplemented with graded level of dried poultry droppings, however, these values were lower than that obtained in this study.

The values recorded in this study indicated that dietary protein of the silages were of high quality since Adeyemi. (2008) observed that red blood cell and haemoglobin were positively correlated with protein quality and protein level in the diets. Values obtained for white blood cell (WBC), lymphocyte and eosinophil counts were found to be within normal range for healthy goats (Sirois, 1995) with is it indicates that the experimental animals were healthy. As precusors for macrophages, Lymphocytes are very key for humoral and cell- mediated immunity responses and monocytes. Hence, they play a vital role in the immune system (Mahgoub, 2008). The range of blood glucose obtained in bucks were similar to the values reported by Mavimbel . (1997) when poultry droppings and urea were fed to sheep as survival ration.

Blood glucose had been used to monitor the nutrient status in animals (Turne. 2005) and animal performance such as weight gain depends on it (Lazzaro, 2001). This also reflected in the weight gain of the animals

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recorded in this study as treatment group with the highest blood glucose had the highest weight gain. Serum protein concentration is an indicator showing the balance between anabolism and catabolism in the body.

However, the range of serum protein obtained in animals fed diets in the present study was below the normal range of 6 – 7.90 g/dL reported by Kaneko (1980). The result above means the experimental diets were able to supply optimum level of protein required to maintain normal serum level. The serum albumin values in this experiment agreed with the report of Cole (1986). The higher concentration of serum albumin observed in animals may be due to the higher digestibility of crude protein observed in these silages when compared with that of control silage. The serum urea concentration is mostly responsible for the breakdown and de-amination of protein in the rumen and the rate of ammonia utilization for bacterial protein synthesis. According to Kaneko (1980), an increase in the serum urea level may reflect an accelerated catabolism rather than a decrease in urinary excretion. The higher concentration of serum urea in all treatments except control silage was in line with the findings of Dass. (1996) who reported that, supplementation of the basal diet of buffaloes with non-protein nitrogen compounds resulted in higher serum urea concentrations.

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Table 4: Blood metabolites of Red Sokoto goats fed urea or poultry manure treated ensiled corncobs

Parameters	Treatments T1	T2	T3	SEM	LS
Sodium	135.00	136.67	135.33	5.28	NS
Potassium	3.50	3.23	3.23	0.83	NS
Chloride	112.00	92.00	90.33	17.31	NS
Urea(mmol/l)	1.50	2.20	2.33	0.97	NS
Creatinine(µmol/L)	182.20	142.30	118.67	65.53	NS
Calcium	1.79	0.85	1.50	0.60	NS
Albumin(g/dL)	2.10	2.20	2.37	0.05	*
Total protein(g/dL)	2.97	3.57	4.17	1.67	NS
Glucose(mmol/L)	2.40	2.50	1.83	0.39	NS
WBC(10^3/uL)	13.52	6.79	11.22	2.90	NS
Lymphocyte	51.00	49.00	50.83	1.14	NS
Neutrophils	45.17	47.00	46.00	2.06	NS
Basophils	0.00	0.00	0.00	0.00	NS
Eosinophils	3.33^b	3.50^a	3.30^b	0.11	*
Monocytes	0.05	0.05	0.05	0.09	NS
RBC(10^6/uL)	3.68	3.31	4.31	0.81	NS
HGB(g/dL)	6.13	8.50	7.53	2.85	NS

Means with different superscript on the same row are significantly different ($P < 0.05$). LS = level of significant, NA = not applicable, * = significantly differed, WBC= white blood cells, RBC= Red blood cells, PCV= Pack cell volume, HGB= Haemoglobin.

CONCLUSION

- Growth performance of bucks fed diets were significantly different (P<0.05) in all the parameters except for the initial weight across the treatments. Bucks feed diets with poultry litter we found to perform best in all the parameters.
- There were significant differences (P> 0.05) in only Albumin and Eosinophils. White blood cell, lymphocytes, neutrophils, basophils, eosinophils and monocytes were within the normal ranges which is an indication the animals were healthy.

Recommendations

The study recommended that farmers should add urea and poultry should be added at the appropriate quantity (1 kg poultry litter / 1 kg corncobs and 1litre of urea solution/ 1kg corncobs) and should not exceed the range as this will cause poor fermentation during ensiling and according to Kaneko (1980), an increase in the serum urea level may reflect an accelerated catabolism rather than a decrease in urinary excretion. However, at recommend levels, silage of corncobs with urea and poultry litter be made a regular practice because the treatment adds nutritional benefit on the poor quality of corncobs. The nutritive quality of treatment with poultry litter was proved to be higher and thus it is recommended for dry season ruminant feeding hence most recommended. It is also recommended that research should be carried out to determine the effect of different ensiling period on the nutritional quality of the silage.

REFERENCES

Adeyemi, O. A., Eruvbetine, D., Oguntona, T., Dipeolu, M. A and Agunbiade, J. A. (2008). Feeding broiler chicken with diets containing whole cassava root meal fermented with rumen filtrate. *Archivos de Zootechnia* , 57: 247- 258.

Aruwayo, A. (2018). Use of Urea Treated Crop Residue in Ruminant Feed. *International Journal of Advances in Scientific Research and Engineering* (IJASRE). http://doi.org/10.31695/IJASRE.2018.32794

A.O.A.C. (2005). Official Methods of Analysis of the Association of Official Agricultural Chemists Washington D. C., USA.

*Belewu, M.A. , Belewu, K.Y and Ogunsola, F.O. (2010) Nutritive value of dietary fungi treated Jatropha curcas kernel cake: Voluntary intake, growth and digestibility coefficient of goat. *Agriculture and Biology Journal of North America,* 1(2): 135-138

Doumas, V. T., Watson, W. A. and Biggs, H. G. (1981). Albumin standards and the measurement of serum albumen with bromocresol green. *Clinical chemical Acta*. (31): 87-96.

Fajemisin, A.N., Chineke, C. M ., Fadiyimu, A.A ., Fajemisin, A.J & Alokan, J.A. (2012). Dietary effects of ensiled corncobs treated with or without water, lye and urea on performance characteristics of West African Dwarf sheep. Proceedings of 17th Annual Conference, Animal Science Association of Nigeria (ASAN) held at International Conference Centre, Opposite Radio House, Area 8, Abuja, (FCT), Nigeria, 9th -13th September, 2012. pp 575-578.

Inweh, D. A., Ikhatua U. J. and Bamikole M. A(2021) Nutrient Intake, Growth and Blood Parameters of West African Dwarf goats fed Composite Diets Comprising of Rumen Waste, Poultry

Waste and Cassava Peels. *Nigerian Journal of Animal Science and Technology*. 4 (3):61 – 71.

Laursen, M. F., Bahl, M. I., Michaelsen, K. F. and Licht, T. R. (2017). First Foods and Gut Microbes. *Frontiers in Microbiology,* 8: 356. DOI 10.3389/fmicb.2017.00356.

Muhammad, A.S., Wada, I.M., Umar, A.M., Abdurrahaman, S.L., Muhammad, Y., Dahiru, M. and Abdullahi, H.I. (2023). Proximate composition, fibre fraction and mineral composition of ensiled rice milling waste enhanced with urea and poultry litter. *FUDMA Journal of Agriculture and Agricultural Technology,* 9(1)*, 85-92*

Nguyen, T.V. & Nguyen, V.T. (2010). A study of making water hyacinth (Eichhornia crassipes) silage by using different substrate sources. Livestock production, climate change and resource depletion, MEKARN Conference 2010.

Oduguwa, B.O., Sanusi, G.O., Fasae, O.A., Oni, O.A. & Arigbede, O.M. (2013). Nutritive value, growth performance and haematological parameters of West African Dwarf sheep fed preserved pineapple fruit waste and cassava byproducts. *Nigerian Journal of Animal Production*. 40(1): 123 – 132.

SAS. (2008). SAS/STAT User's Guide. Version 9.2 for Windows. SAS institute Inc;SAS Campus Drive Carry, North California, U.S.A.

Sofowora A. (1993). Medicinal plants and Traditional medicine in Africa. Spectrum Books Ltd, Ibadan, Nigeria. p. 289.

Kolo, U. M., Adeloye, A. A and Yousuf, M. B. (2018). Influence of urea-fortified corncob diets on growth performance and carcass characteristics in West African dwarf goats, 10(2), 271-281.

Daramola, J. O., Adeloye, A. A., Fatoba, T. A and Soladoye, A. O. (2005). Haemotological and Biochemical parameters of West African goats. *Livestock Research for Rural Development.* Vol. 17. www. Cipav.org.co/Irrd.

Van, Soest, P. J., Robertson, J. B. and Lewis, B. A. (1991).Methods for dietary fiber neutral detergent fiber and non – starch polysaccharides in relation to animal nutrition. *Journal of Dairy Science*. 74, 3583-3597.

Yousuf, M.B., Adeloye A.A., Okukpe K.M., Adeyemi, K.D., Badmus, A.H.A.,Daramola, J. O. and Ogundun, N.J. (2013). Growth performance Characteristics of Goats Fed Varied levels of Poultry Manure in whole Cassava Plant Based Concentrates Diets. *Asian Journal of Agriculture and Rural Development.* 3(11): 823-828

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