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Performance of Growing Yankasa Rams Fed Ensiled Crushed Groundnut Shell, African Locust Bean Pulp and Poultry Litter with Supplementations

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Abstract

A study was conducted to assess the performance of growing Yankasa rams fed ensiled crushed groundnut shell, African locust bean pulp and poultry litter with supplementations. The study was conducted at Abubakar Tafawa Balewa University Teaching and Research Farm, Bauchi. Twenty (20) growing Yankasa rams were fed five supplemental diets plus a basal diet. The study lasted eighty days in a complete randomized design (CRD) of five treatments with four replications. Groundnut shell (GNS) and African locust bean pulp (ALBP) were ensiled with poultry litter as basal diet, Maize bran (MB), cotton seed cake (CSC), groundnut cake (GNC), groundnut haulms (GNH) and urea were used as supplements at various proportions. The basal diet and water were offered ad libitum, three hundred grams (300g) of the supplements were offered before the basal diet to each animal first thing in the morning. Data were taken on feed intake and live weight changes. The results showed that total daily feed intake (996.25g) and total dry matter intake (872.25g) were higher ($P<0.05$) when rams were supplemented with MB and CSC compared to feeding MB alone (854.25g) for total feed intake and (709.25g). Feed conversion ratio and dry matter intake percentage body weight gain were significantly different across the treatment mean. Total crude protein, crude fibre and organic matter intakes were statistically ($P<0.05$) different across the treatment means. It was concluded that based on the performance of the animals in terms of total weight gain, average daily weight gain and feed conversion ratio, feeding ensiled crushed groundnut shell and African locust bean pulp with poultry litter supplemented with MB and CSC gave the best result. It was recommended that ensiled crushed GNS and ALBP with poultry litter be fed to growing Yankasa rams, when supplemented with MB and CSC.

Keywords: Yankasa Rams Fed Ensiled Crushed Groundnut Shell; Locust Bean Pulp; Poultry Litter

Abbreviations

CRD: Complete Randomized Design; GNS: Groundnut Shell; ALBP: African Locust Bean Pulp; MB: Maize Bran; CSC: Cotton Seed Cake; GNC: Groundnut Cake; GNH: Groundnut Haulms; NDF: Neutral Detergent Fibre; ADF: Acid Detergent Fibre; CP: Crude Protein; CF: Crude Fibre; EE: Ether Extracts; CGNS: Crushed Groundnut Shell; PL: Poultry Litter.

Introduction

The intensive system of livestock production and the high cost of conventional feeds have aroused interest in the search for cheaper feedstuffs as substitutes. Agro-industrial by-products which are generated in large amounts every year would be an excellent choice unconventional feed for livestock due to their availability and low cost Swidiq M, et al.

[1]. These feed materials are often rich in carbohydrates in the form of cellulose and hemicellulose Sandra JAK, et al. [2]. Crop residues and by-products are usually consumed fresh by domestic animals. However, it is possible to conserve them for use during periods of feed shortage. Conservation can be achieved by sun drying (hay) and by fermentation (silage) Falola OO, et al. [3]. Type and quality of feed ingredients used in meeting nutritional requirement of ruminant animals play a significant role in combining two or more feed ingredients to produce a balanced ration for feeding ruminants Malgwi IH, et al. [4]. Groundnut shell usually consists of fragment shell with variable amounts of whole or broken kernels Davis JP, et al. [5]. They are the leftover product obtained after the removal of groundnut seed from its pod Duc PA, et al. [6]. Groundnut shells are more palatable and rich in nutrient. It contains various bioactive fuctional components that are beneficial to mankind Duc PA, et al. [6]. Due to their high fibre content, groundnut shell can be used as a roughage source in ruminant diets particularly for beef cattle, sheep and goats Palmer J [7], Millam JJ, et al. [8]. Groundnut shell contain neutral detergent fibre (NDF) of about 47%, acid detergent fibre (ADF), and lignin content of about 36.5% and 6.3%, respectively. Digestibility of groundnut shell ranges from 74 to 88% in ruminants and support animals' growth performance even when fed as sole feed Ozyigit Y, et al. [9]. The African locust bean pulp (Dorawa in Hausa), the yellow colour of the pulp is sweet to taste when ripe, which indicates the presence of sugar and thus a potential energy source, and an indication of the presence of beta carotene which is a precursor of vitamin A, which is known to improve appetite and consequently the growth performance in livestock Gernmah DI, et al. [10], Yakubu AK, et al. [11]. It also contains Vitamin A which is known to have improves laying performance and immune functions in hens Weber GM [12]. The sour taste of the locust bean-pulp is an indication of high value of ascorbic acid (vitamin C) which has beneficial effects on livestock during stressful conditions Malik AA, et al. [13], Kazeem KO, et al. [14].

Materials and Methods

Experimental Site

The experiment was conducted at the Abubakar Tafawa Balewa University Bauchi Teaching and Research farm, located at Yelwa along Tafawa Balewa Road, Bauchi. Bauchi State occupies a land area of about 49,119km^2 (18,965sq mi), approximately 5.3% of Nigerian's total land area. The average annual rainfall ranges from 700mm in the north to 1300mm in the south western part of the state. The rain usually starts in April and ends in October. Minimum temperature of 22°C is usually in December/January while maximum temperature of 40°C is around March/April BSOW [15].

Experimental Animals and Their Management

Twenty (20) growing Yankasa rmas (yearlings) with an initial average weight of 20kg were purchased from livestock Markets (Durun) in Bauchi State. The rams were quarantined, dewormed with *albendazole* given orally and injected against ectoparasites with ivemectine, a broad-spectrum antibiotic, administered subcutaneously. The rams were group fed and managed intensively during a 2-week adaptation period prior to the commencement of the experiment.

Experimental Design and Feeding Procedure

The study was conducted in a completely randomised design (CRD) of five treatments with four replications according to Steel RGD, et al. [16]. Crushed groundnut shell (CGNS), African locust bean pulp (ALBP) and Poultry litter (PL) were mixed in a ratio of (50kg CGNS, 30kg ALBP and 20kg PL). Hundred (100) litres of water was sprinkled on the mixture of (50kg CGNS, 30kg ALBP and 20kg PL). The mixture was ensiled for 21 days in a 300 litre capacity water plastic container as silo according to the methods described by Yakubu AK, et al. [11]. Polyethene was used to further seal the silo after filling with feed materials and compressed. The ensiled material was sun dried to obtain optimum dry matter which was fed as a basal diet.

The supplements used were Maize bran (MB), groundnut haulms (GNH), cotton seed cake (CSC), groundnut cake (GNC) and urea as shown in Table 1. The basal diet was given *ad libitum* to each animal while three hundred grams of the supplements were given to each animal in the morning before the basal diet. Water was also offered *ad-libitum.* After 14 days of adaptation period, the amount of feed (both basal and supplement) by each animal was recorded.

Basal diet	Supplements				
	A	B	C	D	E
CGNS/ALBP/PL	MB+GNC	MB+UREA	MB	MB+GNH	MB+CSC
(50:30:20)	(70:30)	(96:4)	(100)	(50:50)	(50:50)

Table 1: Gross Composition of Basal and Supplemental Diets.
CGNS/ALBP= crushed groundnut shell/African locust bean pulp/poultry litter, MB= maize bran, CSC= cotton seed cake, GNC= groundnut cake, GNH= groundnut haulms.

Data Collection

The animals were weighed prior to the commencement of the experiments and thereafter on a weekly basis in the morning (8-9 am). Daily record of feed intake and left over were taken throughout the study.

Chemical composition of the Basal and Supplemental Diets

Chemical composition of basal and supplemental diets were determined to know their crude protein (CP), crude fibre (CF), ether extracts (EE), and Ash according to AOAC [17].

Data Analysis

Data generated from the study were subjected to analysis of variance (ANOVA) using SPSS version 20. Where differences exist, Duncan's Multiple Range Test was used to separate the means.

Results

The results on chemical composition were shown in Table 2. The basal dry matter content was 79.08% while dry matter content in the supplements ranged from 92.08% in treatment E to 90.44% in treatment C. Basal crude protein (CP) content was 6.071% compare to the CP in the supplements which ranged from 20.91% in treatment D to 11.67% in treatment A. Crude fibre (CF) contents in the supplements ranged from 11.53% in treatment B to 13.13% in treatment E, basal CF was 12.54%. Basal organic matter content was 69.35% and those in the various supplements ranged from 69.35% in treatment A to 88.39% in treatment E. The Ash content in the basal diet was 9.73% compare to the Ash contents in the various supplements which ranged from 3.16% in treatment D to 5.13% in treatment A.

	Treatments					
Components	**Basal Diet**	**A**	**B**	**C**	**D**	**E**
DM	79.08	90.98	91.76	90.44	90.52	92.08
CP	6.07	11.67	20.91	18.18	17.27	17.17
CF	12.54	12.48	11.53	12.82	11.4	13.13
OM	69.35	85.85	87.02	87.01	87.36	88.39
ASH	9.73	5.13	4.74	3.43	3.16	3.69
EE	1.7	2.44	4.6	5.9	2.94	4.45

Table 2: Chemical Composition of Basal and Supplemental Diets (%).

DM= Dry matter, CP= crude protein, CF= crude fibre, OM= Organic matter, EE= Ether extract, NDF= Neutral detergent fibre, ADF= Acid detergent fibre. A (MB+GNC); B (MB+Urea); C (MB); D (MB+GNH); E (MB+CSC) Basal diet= (CGNS/ALBP/PL)

Results on the performance of Yankasa rams were shown in Table 3. There were no significant ($P>0.05$) differences between the treatments in terms of initial body weight, final body weight, total weight gain, average daily weight gain, feed conversion ratio and dry matter intake percentage body weight. The initial weight ranged from 24.50kg in treatment B to 25.00kg in treatment A. Final weight ranged from 29.00kg in treatment C and D to 30.00kg in treatment E. Total weight gain 5.50kg and average daily weight gain 65.75g were recorded in treatment E (MB +CSC) while treatment C containing only maize bran had total weight gain of 4.25kg and the average daily weight gain of 54.50g. Treatment E (MB +CSC) was recorded with the value (12.58) for feed conversion ratio while treatment A (MB + GNC) had (13.25). There were significant differences ($P<0.01$) in terms of basal feed intake, basal dry matter intake, total feed intake and total dry matter intake between the treatment means. Basal and dry matter feed intakes were higher ($P<0.01$) in treatment E (696.25g) and 511.00g than those in treatment C (554.25g) and (438.25g). Total feed intakes was significantly ($P<0.01$) higher in treatment E (996.25g), treatment B (694.74g) and treatment A (673.25g) than those in Treatment C (854.25g) and treatment D (894.00g). There was no significant variation in terms of the supplemental feed and dry matter intakes. Supplemental dry matter intakes ranged from 271.00g in treatment C to 276.00g in treatment E.

Treatments							
Parameters	**A**	**B**	**C**	**D**	**E**	**SEM**	**LOS**
Initial weight(kg)	25	24.5	24.75	24.5	24.75	0.38	NS
Final weight(kg)	29.5	29.5	29	29	30	0.72	NS
Total WG(kg)	4.75	5.25	4.25	4.5	5.5	0.57	NS
ADWG(g)	60.75	64	54.5	56.25	65.75	7.94	NS
FI Basal(g/h/day)	673.25^{a}	694.74^{a}	554.25^{b}	594.00^{b}	696.25^{a}	17.36	*
FI Supp(g/h/day)	300	300	300	300	300	0	NS
Total FI(g/h/day)	973.25^{a}	994.75^{a}	854.25^{b}	894.00^{b}	996.25^{a}	17.36	*
DMI Basal(g/h/day)	532.25^{a}	549.25^{a}	438.25^{b}	469.50^{b}	551.00^{a}	13.7	*
DMI supp(g/h/day)	273	275	271	272	276	0.38	NS
Total DMI(g/h/day)	805.25^{a}	824.75^{a}	709.25^{b}	741.50^{b}	827.25^{a}	13.7	*
FCR	13.25^{a}	12.88^{c}	13.01^{b}	13.18^{a}	12.58^{c}	0.05	*
DMI(%BW)	3	3	2.44	2.55	3	0.32	NS

Table 3: Performance of Growing Yankasa Rams Fed Ensiled Crushed Groundnut Shell, African Locust Bean Pulp and Poultry Litter with Supplementations.

^{abc}, Means within the same row with different superscript are significantly different* (P<0.05).

ADWG = average daily weight gain, F C R = feed conversion ratio, DMI = dry matter intake, FI= feed intake, SUPP= supplement, DMI%BW = dry matter intake percentage body weight. SEM= standard error mean, LOS= level of significance, NS= not significant. WG= weight gain, g/h/day= gram/head/day. A (MB+GNC); B (MB+Urea); C (MB); D (MB+GNH); E (MB+CSC)

Nutrient intakes by growing Yankasa rams are presented in Table 4. There was significant differences (P<0.05) in terms of basal crude protein (CP) intake highest value (33.43g) was recorded in treatment E, followed by treatment A (32.31g) and treatment B (33.34g) while lowest value (26.59g) was recorded in treatment C. Total CP intake also varied significantly (P<0.05) across the treatments, the highest value (90.90g) was recorded in treatment B containing (MB + urea) supplementations while the lowest value (64.16g) total CP intakes was recorded in treatment A. Basal crude fibre (CF) intakes was statistically (P<0.05) higher in treatment E (69.07%) , treatment B (68.88g) and treatment A (66.75g) than those in treatment (58.88g) and treatment C (54.93g). Total CF intakes also significantly differ (P<0.05) across the treatments, the highest value (105.34g) recorded in treatment E followed by treatment A (100.81g) and treatment B (100.61g) while the lowest value (89.71%) recorded in treatment C. Basal organic matter (OM) intakes was statistically (P<0.05) higher in treatment E (382.11g) while the lower value (303.92g) was recorded in treatment C. Total OM intakes also significantly (P<0.05) differed across the treatments. Treatment E, B and A recorded higher values 626.06g, 620.20g, and 603.48g than those in treatment D 563.20g and treatment B 539.71g. There were no significant (P>0.05) effects in terms of supplemental CF, OM, and Ash intake across the treatments. Total Ash intakes differ significantly (P<0.05) across the treatments, treatment B, A and E were having higher values 66.49g, 65.79g and 63.78g than those in treatment C (51.92g) and treatment D 5(4.27g). Total ether extracts (EE) intakes was significantly (P<0.05) higher in treatment D (23.99g), followed by treatment B (21.99g), treatment E21.64g and treatment A (15.69g).

Treatments							
Parameters (g)	**A**	**B**	**C**	**D**	**E**	**SEM**	**LOS**
CP Basal	32.31^{a}	33.34^{a}	26.59^{b}	28.50^{b}	33.43^{a}	0.83	*
CP Supp	31.85^{e}	57.56^{a}	49.32^{b}	46.89^{d}	47.43^{c}	0.05	*
Total CP	64.16^{d}	90.90^{a}	75.91^{c}	75.39^{c}	80.86^{b}	0.83	*
CF Basal	66.75^{a}	68.88^{a}	54.93^{b}	58.88^{b}	69.07^{a}	1.72	*
CF Supp	34.06	31.73	34.78	30.95	36.27	0.1	NS
Total CF	100.81^{a}	100.61^{a}	89.71^{b}	89.83^{b}	105.34^{a}	1.72	*

OM Basal	369.11[a]	380.90[a]	303.93[b]	325.59[b]	382.11[a]	12.43	*
OM Supp	234.37	239.3	235.79	237.61	243.95	0.1	NS
Total OM	603.48[a]	620.20[a]	539.71[b]	563.20[b]	626.06[a]	12.43	*
ASH Basal	51.79[a]	53.45[a]	42.62[b]	45.69[b]	53.59[a]	1.33	*
ASH Supp	14	13.04	9.3	8.58	10.19	0.17	NS
Total ASH	65.79[a]	66.49[a]	51.92[b]	54.27[b]	63.78[a]	1.33	*
EE Basal	9.04[a]	9.33[a]	7.44[b]	7.97[b]	9.35a	0.23	*
EE Supp	6.65[e]	12.66[b]	7.97[d]	16.02[a]	12.29[c]	0.15	*
Total EE	15.69[c]	21.99[b]	15.41[c]	23.99[a]	21.64[b]	0.23	*

Table 4: Nutrient Intakes of Growing Yankasa Rams Fed Ensiled Crushed Groundnut Shell, African Locust Bean Pulp and Poultry Litter with Supplementation.

[abc], Means within the same row with different superscript are significantly different * (P<0.05)

CP= crude protein, CF= crude fibre, OM= organic matter, EE= ether extract, SUPP= supplement, SEM= standard error mean, LOS= level of significance, NS= not significant. A (MB+GNC); B (MB+Urea); C (MB); D (MB+GNH); E (MB+CSC)

Discussions

The ensiled basal diet had a dry matter content of 79.08% while dry matter content for the supplements were (90.44 to 92.08%) which is lower than the DM content (89.68% basal diet) and higher than the DM (88.16 to 91.24% supplements) reported by Yerima J, et al. [18]. The DM contents in this study were also higher than that of Inuwa M, et al. [19] when the author fed cattle fore-stomach digesta ensiled with locust bean pulp and NPN to Uda rams. The crude protein content of the basal diet was low (6.07%) compare to that of Yerima J, et al. [18] who reported CP content of (12.6%) for basal diet. CP content of the supplements ranged from (11.67 to 20.91%) higher than the CP contents (14.90 to 15.85%) reported by Yahya MM, et al. [20] when graded levels of probiotics supplemented sugarcane bagasse was fed to red Sokoto Goats. The high crude protein content of the supplemental diets showed that it is high enough to meet the optimum microbial need in the rumen. The crude fibre contents (12.54%) of the basal diet and that of the supplements that ranged from (11.40 to 13.13%) were lower compare than the CF contents (22.29 to 26.09%) observed by Ashiru RM, et al. [21] when growing Yankasa sheep were fed complete ration containing different inclusion level of ensiled sugarcane waste and poultry litter. The organic matter (OM) content of the basal diet was lower (69.35%) than that of the Yerima J, et al. [18] which reported OM content of (82.63%), OM of the supplements ranges from (85.85 to 88.39%) which is also lower than the OM contents (92.50 to 94.60%) reported by Abdullahi M, et al. [22] when the author fed urea ensiled sesame chaff supplemented with varying proportion of protein and energy source to growing Yankasa sheep. The Ash content (9.73%) of the basal diet in this present study was higher to that of Yerima J, et al. [18] that reported (5.64%) but lower than the ash content (11.75%) obtained by Yakubu AK, et al. [11]. The ether extracts (EE) in the present study (1.70 to 5.90%) were slightly comparable to the EE contents (2.90 to 4.79%) reported by Adebisi IA, et al. [23]. Whose determine Nutritional potential of differently processed *Cajanus cajan* leaves on nutrient digestibility and nitrogen utilization of West African dwarf growing rams fed *Panicum maximum.*

The weight gain and average daily weight gain in the present study (5.50kg) and (65.75g) were lower than the weight gain (6.75kg) reported by Salisu SG, et al. [24] when Yankasa rams were fed groundnut haulms and maize stover in a total mixed ration in Northan Guinea Savannah. But higher than the weight gain (2.75kg) obtained by Millam JJ, et al. [8]. The DMI%BW in this study (2.00 to 3.3.00) were lower than the DMI% (2.95 to 3.04%) reported by Yakubu AK, et al. [11], but higher than (2.48 to 2.93%) reported by Yerima J, et al. [18]. The DMI%BW generally indicates that the animals on the various diets showed positive DM status by consuming more than two (2) percent of their body weight. The values (12.58 to 13.25) obtained for feed conversion ratio were higher than (5.23 to 8.49) reported by Abdullahi S, et al. [25]. The basal and dry matter feed intakes (696.25g) and 551.00g) in this study were higher than the feed and dry matter intakes (285.00g) and (328.75g) reported by Abdullahi S, et al. [25]. When the author determine the performance of Yankasa rams fed urea treated sorghum chaff as a basal diet supplemented with maize offal in semi-arid environment of Nigeria. But lower than the DMI (888.44) and (927.08g) obtained by Salisu SG, et al. [24]. Total feed and dry matter intakes recorded (996.25g) and (827.25g) correspond with the (971.50g) and (807.25g) obtained by Muhammad N, et al. [26], but lower than (2000.07g) and (2057.00g) by Ashiru RM, et al. [21].

The total crude protein (CP) intakes (64.16 to 90.90g) were lower than the CP intake (146.93 to 159.19g) reported by

Kwaido AA, et al. [27]. When the author fed ensiled fore-stoamch digest with urea and rice milling waste to Uda rams. The values (89.71 to 105.34g) obtained for total crude fibre (CF) were lower than the (226.50 to 254.50g) and (274.07 to 310.85g) reported by Muhammad N, et al. [26], Kwaido AA, et al. [27]. The total ash intake in the present study (51.921 to 66.49) were lower than the (68.00 to 133.39) reported by Yakubu AK, et al. [11]. But higher than the ash intake reported by Garba Y, et al. [28]. When graded levels of *Tamarindus indica* leaves were fed to Yanksa rams. Total organic matter (OM) intake (539.71 to 626.06) in this experiment was lower than the OM (1067.89 to 1102.98) reported by Abdullahi M, et al. [22]. When the author determine nutrient intake and performance of growing Yankasa sheep fed urea ensiled Sesame chaff supplemented with varying proportion of protein and energy source. Ether extracts (EE) intake recorded in this experiment were lower than what was obtained by Tukur HM, et al. [29] when fattening rams fed varying level of fore-stomach digesta.

Conclusion and Recommendation

It was concluded that feeding value of groundnut shell (GNS) and African locust bean pulp (ALBP) can be enhanced by ensiling with poultry litter improves it nutritive value based on the performance of animals in terms of weight gain, average daily weight gain and feed conversion ratio, feeding ensiled crushed groundnut shell and African locust bean pulp with poultry litter when supplemented with maize bran and cotton seed cake gave a best result. Ensiled CGNS and ALBP with poultry litter fed to growing Yankasa rams gave best daily weight gain of 65.75g/head/day when supplemented with 300g of maize bran and cotton seed cake. Therefore, this diet is recommended for growing Yankasa rams.

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