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Growth Response and Cost-benefit of Red Sokoto Goats Feedlotted on Crop Residues during Dry Season

*Idongesit Sylva-Nyom, Gilbert J. Bandawa, Abdullahi J. Kure, Ja'afar L. Gora, Nkpusireufu G. Dubagari, Mohammed D. Buba, and Buba Babuwa

Department of Animal Health & Production Technology, Federal Polytechnic, Bali, Taraba State, Nigeria

*Corresponding author email: mrsidysylva@gmail.com Tel: 08034418487

Abstract

Fifteen Red Sokoto bucks were assigned to five treatment diets designated as T1, T2I, T3, T4 and T5 with cowpea husk inclusion levels at 0%, 25%, 50%, 75% and 100% to replace cowpea haulms. The feeding trial lasted for 90 days. Daily feed intake was measured by subtracting the leftover feed from the amount offered within 24 hours. Also, weight changes were measured by taking the weight of each animal at the end of the week and the weekly initial weight subtracted from it. The running cost was measured by summing all costs incurred in the production. Parameters measured were daily feed consumption, daily weight changes, daily running costs in the form of man-hour labor charges, drugs, revenue, transportation and other charges. Data obtained were subjected to analysis of variance (ANOVA) and net farm income (NFI) to carry out the cost-benefit analysis. Results of the research showed no significant differences ($p>0.05$) among the treatment means for initial body weight 5.53, 5.71, 5.87, 5.93 and 5.90 for T1, T2, T3, T4 and T5 respectively. Feed intake varied among the treatments probably due to inclusion levels of cowpea husk. T5 had the highest feed intake (0.260kg) followed by T4 (0.25kg) and T3 (0.24kg) with significant differences ($p<0.05$) across treatments. Similarly, bucks on T5 performed well in terms of body weight gains (4.60kg) followed by T4 (4.13kg) and T3 (3.47kg) with significant differences ($p<0.05$) across treatments. The feed conversion ratio was highest in bucks on T3 (6.01) where cowpea husks and haulms inclusion were 50:50 because animals can utilize nutrient pool from both feedstuffs. Bucks on T3, T4 and T5 had the highest revenue (₦3,1600.00) followed by T1 and T2 (₦25,600.00). Profits per naira invested varied across treatment groups with T1 (₦6,850.00), T2 (₦6,700.00), T3 ₦12,800.00), T4 (₦12,650.00) and T5 (₦12,150.00). Costs per kilogram weight gain were ₦2,072.00, ₦1,881.00, ₦1,808.00, ₦1,528.00 and ₦1,409.00 for treatments T1, T2, T3, T4 and T5 respectively. The economic

analysis of the research showed an average gross farm income of ₦3,140.00 per head of animals which implies a profitable venture using these crop residues.

Keywords: Red Sokoto goats, Crop residues, Intake, Weight gain, Cost-benefit

1.0 Introduction

Crop residues are important to feed resources, and an increase in ruminant animal production can be accomplished through improved utilization of crop residues (FAO, 2023). Crop residues such as sorghum stover, cowpea haulms and cowpea husk are vital conventional feedstuffs for ruminants. Large tons of crop residues are generated yearly which could result in environmental pollution if not recycled or consumed by livestock. According to Adetunji and Adejumo (2018), efforts are being geared towards harnessing crop residues or by-products into animal feed. Ruminants are usually faced with a scarcity of high-quality feedstuffs during the dry spell due to over-dependence on pasture materials of poor quality and quantity at this time of the year.

Sorghum stover is the mature cured stalks from sorghum crop with the grain removed. The stovers are relatively poor in nutritive value but are often widely used for feeding ruminants when other feeds are inadequate or unavailable towards the end of the dry season (Bean, 2020). Cowpea husk is the residue after the cowpea has been processed into the clean whole grain. Adeloye (1995) reported that it is well accepted by the goats and could serve as an efficient fattening ration and dry-season feed for the ruminants. Cowpea husk has been successfully used to feed rabbits to mature body weight (Isaac et al., 2020). Cowpea husk can be stored during the period of scarcity or off-season. In addition, the use of cowpea husks and other straws, by-products and agriculture wastes could be fed to animals to reduce their cost of production (Omer et al., 2012; Omer and Badr, 2013) as well as reduce hazards of environmental pollution arising from indiscriminate burning or dumping of such straws, by-products or agricultural wastes (Isaac et al., 2020). Cowpea haulms are the leaves and twigs left after harvesting cowpea with the pods intact. They are already an important fodder source for livestock in crop-livestock systems in the Sahel regions of West Africa where feed scarcity and seasonality is the major constraint to improved livestock production (Agyemang, 2002). Adeloye (1995) reported that it is well accepted by the goats and could serve as an efficient fattening ration and dry-season feed for the ruminants.

Red Sokoto goat (or Maradi) is very common in the Northern part of Nigeria, especially in Sokoto province and is a breed native to northern Nigeria and southern Chad (Sam,2012; Alponsus et al., 2010). It is also a good meat and milk producer, provides manure and has other traditional uses (Schoenian, 2013). Red Sokoto goats are seen to survive favorably in other climates such as the guinea savanna (Sylva-Nyom, 2013).

Goats can be successfully fed a variety of feedstuff and can be marketed at various weights, ages and body conditions (Ahamefule et al., 2005). Profitability is influenced by season, year, genetics and management (Schoenian, 2013). Feeding is the most important part of commercial goat production and maximum profit is mostly dependent on feeding high-quality fresh and nutritious feed (Ahamefule et al., 2005). Farming for profit requires that a farmer grows crops or livestock that can be sold in the market profitably (Babale et al., 2018; Sam et al. 2017).

Therefore, the objective of this study was to evaluate the growth performance and cost-benefit of feedlotting Red Sokoto goats with selected crop residues.

2.0 Materials and Methods

2.1 Location of Study Area

The research was carried out in the Teaching and Research Farm of Federal Polytechnic, Bali B ward, Bali Local Government Area (LGA) of Taraba state, Nigeria. Bali covers a total land area of about 5,500km and extends between latitude 8O and 35' 00'' North of the equator and 10O 46' 00'' East of the Greenwich Meridian (Taraba State Government, 2015). Bali lies within the Guinea Savannah Zone with climatic conditions characterized by dry and rainy seasons. Rainfall varies between 1000mm and 1500mm per annum, with temperature ranges from 30^{o} C to 38^{o} C depending on the season (Taraba State Government, 2015).

2.2 Experimental Animal and Diets

Fifteen weaned Red Sokoto goats of about five (5) months of age were sourced from the Goat unit of the Teaching and Research Farm, and used to experiment. Crop residues were sourced from the Gazabu grain market in Bali B, Bali L.G.A, crushed and used to compound the treatment diets. Five diets were formulated using cowpea haulms and cowpea husks as test ingredients in graded levels of 0%, 25%, 50%, 75% and 100% designated as T1, T2, T3, T4 and T5. Each goat represented a replicate giving a total of 3 goats per treatment.

Table 2.1: Composition of treatment diets (%)

Ingredients	T_1	T_2	T_3	T_4	T_5
Sorghum stover	50.00	50.00	50.00	50.00	50.00
Cowpea husk	0 .00	11.75	23.50	35.25	47.00
Cowpea haulms	47.00	35.25	23.50	11.75	0.00
Bone ash	2.00	2.00	2.00	2.00	2.00
Common salt	1.00	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis (%)					
Crude protein	10.00	9.30	9.00	8.10	7.40
Crude fibre	29.20	29.92	30.59	31.32	32.00
Ether extract	10.26	10.12	9.65	9.72	9.47
Ash	8.00	7.65	7.40	7.00	6.69
ME (Kcal/kg)	5481	5295	5108	4971	4734

2.3 Data collection

Experimental animals were weighed before the feeding trials and subsequently weighed weekly for 13 weeks to get the weight changes. The weight of the animal at the end of each week was taken and recorded. Daily weight gain was calculated for each treatment group by subtracting initial weight from each weekly weight. Total weight was obtained by summing up all weekly weights. The quantity of leftovers was subtracted from the feed offered to obtain the daily feed intake. The sum of daily feed intake for each week made up the weekly feed intake while total feed intake was the sum of all weekly intakes. The feed conversion ratio was also obtained for each group as shown below:

$$Feed\ conversion\ ratio = \frac{Average\ feed\ intake}{Average\ body\ weight\ gain} \quad \text{.....Equation 2.1}$$

The cost of the feed including services such as transportation, processing of test ingredients and the labor charge was used to obtain the cost of feed per kg diet.

2.4 Experimental Design and Statistical Analysis

A completely randomized design was used in the experiment. All data collected during this study were subjected to analysis of variance (ANOVA) appropriate for a completely randomized design (Steel and Torrie, 1980) using Minitab (2004), statistical software version 16. Net farm income (NFI) analysis as described by Jabo et al. (2010) was used to carry out the cost-benefit analysis which is specified by Aderinola and Akinrinola (2005) as cited by Babale et al. (2018) as follows:

$$NI = TR - (TVC + TFC) \text{.....Equation 2.2}$$

Where:

NI =Net income (profit of the product in Naira/Kg)

TR=Total revenue of the ith product in Naira/Kg

TVC= Total variable costs of the ith product in Naira/Kg

TFC=Total fixed costs of the ith product in Naira/Kg.

3.0 Results and Discussion

3.1 Intake and growth performance of RSG fed varying levels of crop residues

Table 3.1 shows the intake and growth performance of Red Sokoto goats fed varying levels of crop residues. There was no significant difference ($p>0.05$) among treatment means for initial body weight. Feed intake varied among treatments probably due to inclusion levels of cowpea husk. Bucks on T5 had the highest feed intake (0.26kg: 100% replacement of cowpea haulms with cowpea husk) followed by T4 (0.25kg: 75% cowpea husk) and T3 (0.24kg: 50% cowpea husk) with significant differences ($p<0.05$) across treatment. This is in line with Adejumo et al. (2020) who reported a good intake of cowpea husk diet. It could also be attributed to the high fiber content of the diets. But it is lower than 668.4g reported by Mohammad and Ramli (2014) when they fed goats with Napier grass and oil palm frond supplemented with Soy waste, and 417g reported by Babale et al. (2018) when West African Dwarf goats were fed varying levels of cowpea husk and groundnut haulms. Similarly, bucks on T5 performed well in terms of body weight gains (4.60kg) followed by T4 (4.13kg) and T3 (3.47kg) with significant differences ($p<0.05$) among the treatment group. This is similar to the report by Adeloye (1995) who recorded a good growth rate for goats, and Adetunji and Adejumo (2020) who recorded high growth rates for rabbits. Also, Babale et al. (2018) reported that good results in growth rate were achieved when cowpea haulms were included at 50%. The report from this study was higher than the 185g reported by Mtenga et al. (2005) and 66.07g obtained by Nyako (2016). However, the feed conversion ratio was highest in bucks on T3 (6.01) where cowpea husks and haulms inclusion were 50:50, followed by T1 (5.9: 0% cowpea husk). This agrees with the reports that goats can perform excellently on cowpea haulms (Babale et al. 2018). Rabbits were reported to perform well on cowpea haulms in a similar study by Alli-Balogun et al. (2003).

Table 3.1: Intake and growth performance of RSG fed varying levels of crop residues (kg)

Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**	**LS**
IBW	5.53	5.72	5.87	5.93	5.90	0.12	**Ns**
DFI	0.21^{c}	0.21^{c}	0.24^{b}	0.25^{b}	0.26^{a}	2.58	*
WFI	1.45^{d}	1.45^{d}	1.69^{c}	1.74^{b}	1.83^{a}	0.01	*
TFI	17.56^{d}	17.40^{d}	20.32^{c}	20.84^{b}	21.96^{a}	0.12	*
FBW	8.55^{c}	9.07^{bc}	9.33^{abc}	10.07^{ab}	10.50^{a}	0.39	*
WBWG	0.28^{b}	0.28^{b}	0.29^{b}	0.35^{ab}	0.39^{a}	0.02	*
TWG	3.02^{c}	3.35^{bc}	3.47^{bc}	4.13^{ab}	4.60^{a}	0.24	*
DWG	0.04^{b}	0.04^{b}	0.04^{b}	0.05^{ab}	0.06^{a}	0.00	*
FCR	5.9^{a}	5.33^{ab}	6.01^{a}	5.03^{ab}	4.81^{b}	0.32	*

RSG=Red Sokoto goats, IBW= Initial body weight, DFI=Daily feed intake, WFI=Weekly feed intake, TFI= Total feed intake, FBW= Final body weight, WBWG=Weekly body weight gain, TWG=Total weight gain, DWG= Daily weight gain, FCR=Feed conversion ratio.

The 6.01 FCR is similar to the 6.12 obtained by Babale et al. (2018) when West African Dwarf goats were fed cowpea haulms. He added that feed conversion efficiency is a function of feed intake and weight gain, and nutrient intake in a feed is a function of the amount of feed eaten and the nutrient levels in the diet. Bucks on T5 (4.813) had the lowest FCR value even though they recorded the highest intake and weight gains. This, however, negates the position of Babale et al. (2018) that growth rate (weight gain) requires extra feed intake above what is required for maintenance and a faster growth rate means better feed conversion efficiency because it makes more use of feed available for production (Schoenian, 2013). The lowest FCR in T5 might be due to low metabolizable energy in the diet or an underlying health challenge.

Table 3.2: Cost-benefits ratio of feedlotting RSGs on varying levels of crop residue (₦)

Parameter	T1	T2	T3	T4	T5
Cost of goats	12000	13000	14000	15000	15000
Cost of equipment	1500	1500	1500	1500	1500
Cost medication	550	550	550	550	550
Cost of feed	1600	1750	1650	1800	1850
Cost of water	300	300	300	300	300
Cost of transport	800	800	800	800	800
Cost of labour	2000	2000	2000	2000	2000
Depreciation	300	300	300	300	300
Total cost	18750	18900	18800	18950	19450
Sales of equipment	1200	1200	1200	1200	1200
Sales of animals	24000	24000	30000	30000	30000
Sales of manure	400	400	400	400	400
Total revenue	25600	25600	31600	31600	31600
Profit/Naira invested	6850	6700	12800	12650	12150
Final weight (kg)	8.550	9.067	9.333	10.067	10.500
Initial weight (kg)	5.533	5.717	5.867	5.933	5.900
Weight gain(kg)	3.017	3.350	3.467	4.133	4.600
Cost/weight gain (₦)	2072	1881	1808	1528	1409
Gross income/animal	2283.33	2233.33	4266.66	4216.66	4050.00

RSGs= Red Sokoto goats

3.2 Cost-benefits ratio of feedlotting RSGs on varying levels of crop residue

Table 3.2 shows the cost-benefits of feedlotting Red Sokoto goats on varying levels of crop residue in naira. The bucks on T3, T4 and T5 had the highest revenue (₦31,600.00) followed by T1 and T2 (₦25,600.00). This is because the experimental animals were bought from one source at an agreed price and the other costs were shared across treatment groups. Profits per naira invested varied across treatments with T1 (₦6,850.00), T2 (₦6,700.00), T3 (₦12,800.00), T4 (₦12,650.00) and T5 (₦12,150.00) with cost per kilogram weight gained as ₦2,072.00, ₦1,881.00, ₦1,808.00, ₦1,528.00 and ₦1,409.00 for treatments T1, T2, T3, T4 and T5 respectively. The economic analysis of the research showed an average gross farm income of ₦3,140.00 per head of the animal implying that the experiment was a profitable venture. The highest turnover of ₦4,266.66 was obtained with bucks on treatment T3 (50% cowpea husk and 50% cowpea haulm) followed by those in T4 with ₦4,216.66 (75% cowpea husk) and T5 with ₦4,050.00 (100% cowpea husk). Economic efficiency of production was found to decrease with an increase in the level of cowpea husk inclusion in the diet. Babale et al. (2018) observed a similar trend of decrease among treatment groups (₦7,110.00, ₦7,040.00, ₦6,560.00, ₦6,436.67 for T1, T2, T3, T4 respectively) when groundnut haulm was fed at 10, 30, 70 and 90% to replace cowpea husk at 90, 70, 30 and 10% respectively.

4.0 Conclusion/recommendation

It was concluded that proportional inclusion of cowpea husks (50:50) in combination with cowpea haulms brings more efficient nutrient utilization, and a higher rate of weight gain, thus, a higher profit in goat fattening.

When crop residues are utilized in a feedlot operation for Red Sokoto goats where cowpea haulms, cowpea husks and sorghum stover are feed ingredients, it is recommended that the percentage inclusion of cowpea haulms and cowpea husks should be 50:50 to ensure good feed intake, better feed efficiency ratios and profitability in a goat fattening program.

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