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COST BENEFIT ANALYSIS OF FEEDING COWPEA HAY AND GROUNDNUT HAULMS AS SUPPLEMENTS TO BASAL RICE STRAW IN YANKASA RAMS

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ABSTRACT

The study was conducted to assess the influence of cowpea hay and groundnut haulms supplementation on cost of feeding and growth attributes of Yankasa rams. Sixteen Yankasa rams weighing averagely 20.19 ± 2.2kg were randomly assigned to four treatments viz, rice straw (Treatment I), groundnut haulms (Treatment II), cowpea hay (Treatment III) and combination of cowpea and groundnut haulms supplementations (Treatment IV) in a Completely Randomized Design (CRD) with four (4) replications. The animals were fed experimental diets, concentrate at 1.5% body weight and supplements while rice straw was fed as basal diet *ad libitum* to all the experimental animals. The results for growth performance revealed significant ($P<0.05$) differences in all the parameters evaluated except concentrate intake and feed efficiency. Cost of feed/kg live weight gain was significantly ($P<0.05$) reduced in treatments III compared to other treatments. The results of cost of feed/kg live weight gains of Yankasa rams fed with cowpea hay, groundnut haulms as supplements to basal rice straw indicated a decrease in cost of feed per kilogram of the gain. Treatment III had the least and best cost of feed/kg live weight gains of ₦1451.20/kg followed by treatment II. Treatment I had the highest cost of feed/kg live weight gains of ₦2539.62/kg. The findings from this study implies that, supplementation of basal rice straw with cowpea hay and groundnut haulm improves the performance of Yankasa rams by 42.62% (8.63kg) and 40.00% (8.0kg), respectively in comparison to 25.61% (5.25kg) to the control.

Keywords: Cost-benefit, Cowpea hay, Groundnut hauls, Rice straw, Supplementation, Yankasa rams

INTRODUCTION

The quality and quantity of feeds are constraints to increasing ruminant productivity under tropical conditions. Existing feedstuffs in the tropical countries often provide inadequate energy, protein, minerals and vitamins to support optimum animal productivity (Tripathi *et al.*, 2006). In the sub-Saharan Africa, poor nutrition remains the widest constraint to good ruminants' production. Feed scarcity becomes more critical during the dry session when feed is inadequate, but the quality becomes extremely poor. The dietary energy (10.05 mg/kg DM) and protein (5.6%) obtained from natural pastures and crop residues particularly in the dry session are generally too low to meet the nutrient requirements of ruminants for maintenance and production (Birnin-Yauri and Umar, 2014). In Nigeria like most developing countries, the ruminant livestock production has depended on natural pastures and crop residue feed base (Adugna, 2007). It is therefore, apparent that feed from resource base natural pasture and crop residues is insufficient to provide the minimum crude protein requirements to rumen microorganisms and their host animals (Hidosa, 2017).

Residues of leguminous crops are relatively high in crude protein (CP), according to Tolera (2008) groundnut haulms has a CP value of 15.3% compared to 5.6% CP of sorghum stover. The consumption of animal protein in Nigeria has always fallen short of expectation as stated by Nkwocha *et al.* (2018) and the total recommended protein intake for growth and development in man is 85.9 per caput per day and 39g should be from animal origin (Nkwocha *et al.*, 2018). According to FAO (2005), an average Nigerian consume only about 33g of protein per caput per day. This is 52.9g below the recommended level (85.9g). Therefore, there is need for increase in livestock production in order to improve the nutritional status of Nigerians through the provision of high quality animal protein such as meat. Mutton is an excellent food source for human consumption because it is a nutrient dense food that provides high quality protein, essential minerals and vitamins such as iron, zinc, vitamin B_{12} and omega -3-fatty acid (Ozung *et al.*, 2011). Yankasa rams are among the major sources of mutton in Nigeria that were mostly raised under semi intensive and extensive system. The problem of livestock production in the Northern part of Nigeria centered towards limited availability of feed (Onyeonagu and Njoku, 2010). Ruminant animals in these parts mainly depend on native rangeland and crop residues from farmlands (Onyeonagu and Njoku, 2010).

The problem of feed shortage is severe during the dry session which is approximately seven months when livestock subsist on very poor quality forages and crop residues, pastures and crop residues are dried and highly lignified (Savadogo *et al.*, 2000). The severity of feed shortage that occurs during the long dry season when available forage is dry and their protein content is low leads to marked decrease in voluntary intake and digestibility by the animals leading to very low levels of performance (Lamidi *et al.*, 2010). Another problem facing developing countries is the underutilization of a considerable quantity of crop residues, agro-industrial by-products and animal by-products that are generated every year (Aregheore and Chimwano, 1991). Thomson *et al.* (2000) reported that deficiencies of protein, energy and minerals are the main nutritional factors limiting productivity of animals in tropical regions. Insufficient nitrogen supplies for rumen microbes result in low microbial protein synthesis and intestinal amino acid absorption which can limit forage intake and impair animal performance (Osuji *et al.*, 1995). This triggered an interest in the use of legume haulms as supplements in animal rations (Bunyapraphatsara, 2007). This study therefore aimed at determining the influence of cowpea hay and groundnut

haulms supplementation to basal rice straw on growth performance and cost of feed/kg live weight gains of Yankasa rams.

MATERIAL AND METHODS

Study Location

The study was conducted at the Small Ruminant Unit of Livestock Teaching and Research Farm Gaya, Department of Animal Science, Kano University of Science and Technology, Wudil, Kano State (Latitude 11º 5´N and longitude 9º 40´E and on an elevation of 415m, above sea level). The area has a minimum and maximum temperature of about of 26ºC to 36ºC, respectively. The mean annual rainfall of the area is 773.4 mm (Adamu *et al.*, 2014).

Sources of Experimental Feeds

Cowpea hay and groundnut haulms were purchased from Wudil market, Kano state. They were bagged separately in clean sacks and labelled accordingly. The rice straw was obtained from a rice farm at Wudil town, Kano. The rice straw was chopped using a forage chopper to size of 4 cm length and bagged. Other feed ingredients were purchased from the same market. All the experimental feeds were bagged properly and stored until required for use.

Experimental Animals

Sixteen (16) growing Yankasa rams weighing averagely (20.19 ±2.2kg) were purchased from Wudil Market, Kano State for the experiment. The animals were quarantined for a period of two weeks. The animals were dewormed against internal and external parasites using Ivomec® Super at 200µg/kg body weight prior to experiment.

Experimental Treatments and Design

The experimental Yankasa rams were randomly divided into four groups (I-IV). The experiment was laid down in a Completely Randomized Design (CRD) with four (4) replications. To the first group (Treatment I), rice straw was offered *ad libitum* as control. The second group (Treatment II) received groundnut haulms at 300g /day and rice straw *ad libitum*. Treatment III was given 300g /day cowpea hay and rice straw *ad libitum.* Treatment IV was a combination of groundnut haulms with cowpea hay (150g/day Groundnut haulms + 150g/day Cowpea hay) + and rice straw offered *ad libitum*.

Feeding and Management

The experimental animals were fed wheat bran and rice straw for two (2) weeks during the period of adaptation. The experimental animals were balanced by weight before being allotted to the treatment groups and were divided into four (4) groups of four (4) animals each. A concentrate diet containing wheat bran (WB) and sorghum chaff mixed in a ratio 2:1, (1% salt and 1% bone meal) were mixed and given at 1.5% body weight to all the experimental animals once daily. The experimental diets were given twice a day in the morning at 8:00 am after concentrates feeding and afternoon at 4:00 pm while rice straw was fed *ad libitum* to all the experimental animals. After the adaptation period the experiment lasted for 12 weeks (84) days.

Cost Benefits Analysis

Cost benefit analysis was carried out to determine the profitability of feeding frequency of cowpea hay and groundnut haulms to Yankasa rams. Both inputs and products costs were based on cost at the prevailing producers market price of the commodities.

- Cost of feed/kg(N/kg) = kg of feed consumed x cost/kg of feed.
- Cost of feed consumed/day=Cost of feed/kg x Feed Intake
- Cost of feed/kg Live Weight Gain
  = $\frac{\text{Cost of feed consumed}}{\text{Average Daily Gain}}$

Statistical Analysis

The data collected were subjected to Analysis of Variance (ANOVA) using SAS (2004) version 9.1; were there is significant difference means were separated using Least Significant Difference (LSD) at 5% level of probability.

RESULTS

Growth Performance of Yankasa Rams Fed Cowpea Hay and Groundnut Haulms as Supplement to Basal Rice Straw

The influence of cowpea hay and groundnut haulms as supplements to basal rice straw on growth performance by Yankasa rams is shown in Table 1. The results showed that there were significant ($P<0.05$) differences between treatment means in all the parameters evaluated except concentrate intake (CI) and feed efficiency (FE) for CI. Final body weight values 28.00kg (TII) and 28.88kg (TIII) were significantly ($P<0.05$) higher than values obtained in other treatments, followed by the value obtained in treatment IV, the value recorded for the control was significantly ($P<0.05$) lower. The results for weight gain values recorded in the present study followed the same pattern as final weight gains and average daily gain (ADG). Supplement intake mean value (388.43g/day) was significantly ($P<0.05$) higher in treatment III, values recorded for other treatments were significantly ($P<0.05$) different. Roughage mean value was significantly ($P<0.05$) higher in treatment I, values recorded for other treatments were significantly ($P<0.05$) different. The total feed intake was significantly ($P<0.05$) higher in treatment III, followed by the value obtained in treatment I. Feed conversion ratio value recorded followed the same pattern with roughage intake. The feed conversion ratio of 5.40 (TII) and 5.74 (TIV), were significantly ($P<0.05$) lower than in other treatments.

Cost of feed/kg live weight gains of Yankasa Rams Fed Cowpea hay and Groundnut haulms as supplements to Basal Rice Straw

The results of cost of feed/kg live weight gains of Yankasa rams fed with cowpea hay, groundnut haulms as supplements to basal rice straw (Table 2) indicated a decrease in cost of feed per kilogram of the gain. Treatment III had the least and best cost of feed/kg live weight gains of ₦1451.20/kg followed by treatment II. Treatment I had the highest cost of feed/kg live weight gains of ₦2539.62/kg.

Table 1: Growth Performance of Yankasa fed Cowpea hay and Groundnut haulms as Supplements to Basal Rice Straw

	TREATMENTS				
Parameters	**I(RS)**	**II(GNH)**	**III(CPH)**	**IV(GNH+CPH)**	**±SEM**
Initial Body Weight (kg)	20.25	20.00	20.25	20.25	1.74
Final Body Weight (kg)	25.50^{c}	28.00^{a}	28.88^{a}	27.00^{b}	2.25
Weight Gain (kg)	5.25^{c}	8.00^{a}	8.63^{a}	6.75^{b}	1.31
Average Daily Gain (g/day)	62.50^{c}	95.24^{a}	102.74^{a}	80.36^{b}	0.02
Concentrate Intake (g/day)	377.26	458.87	415.79	391.67	51.39
Supplement Intake (g/day)	0.00^{d}	131.94^{b}	388.43^{a}	126.38^{c}	23.77
Roughage Intake (g/day)	327.96^{a}	54.98^{c}	63.84^{b}	49.47^{d}	42.23
Total Feed Intake (kg/day)	0.71^{b}	0.65^{c}	0.87^{a}	0.57^{d}	0.21
Feed Conversion Ratio	8.69^{a}	5.40^{c}	6.36^{b}	5.74^{c}	1.04
Feed Efficiency	0.12	0.20	0.16	0.19	0.03

KEY: ^{abcd} Means with the same superscript within the same row are not significantly (P<0.05) different
SEM = Standard Error of Mean
I= RS/Rice Straw II= Groundnut Haulms III= Cowpea Hay IV= Cowpea + Groundnut Hay
RS: Rice Straw GNH: Groundnut Haulm CPH: Cowpea Hay GNH+CPH: Groundnut Haulm+Cowpea Hay

Table 2: Cost of feed/kg live weight gains of Yankasa Rams Fed Cowpea hay and Groundnut haulms as supplements to Basal Rice Straw

	TREATMENTS				
Parameters (kg/day)	**I(RS)**	**II(GNH)**	**III(CPH)**	**IV(GNH+CPH)**	**SEM**
Cost of feed/kg (₦)	286.16	312.57	233.53	356.44	22.25
Cost of Feed Consumed (₦/kg)	203.17	203.17	203.17	203.17	0.001
Cost of Feed/Kg Gain (₦/kg)	2539.62^{a}	1562.85^{c}	1451.20^{d}	1847.00^{b}	109.23

^{abc} Means with the same superscript within the same row are not significantly (P<0.05) different SEM = Standard Error of Mean KEY:
I= Rice straw II= Groundnut Haulms III= Cowpea Hay IV= Cowpea Hay + Groundnut Hay
Hay RS: Rice Straw GNH: Groundnut Haulm CPH: Cowpea Hay GNH+CPH: Groundnut Haulm + Cowpea Hay, ₦ = Naira (Nigerian Currency), Kg= Kilogram

DISCUSSION

There were improvements in the growth performances in all the experimental animals fed basal rice straw supplemented with cowpea hay and groundnut haulms. This means that, intake of rice straw increases when supplemented with leguminous crops residues. This finding is in line with that of Musa (2016) who reported that, total feed intake generally increased with increasing level of legumes supplementation. The high average daily weight gain of Yankasa rams fed diets supplemented with cowpea hay can be attributed probably to the adequate energy and protein provided which are critical for their growth. This finding agrees with that of Adamu (2015) who reported average daily weight gain of Yankasa rams fed with graded levels of groundnut haulms supplementation to be 150 g/day. The total feed intake was higher in experimental animals fed with cowpea hays (Treatment III) supplemented diets and lower in a combined treatment group (Treatment IV). The higher feed intake observed on animals fed with cowpea hay supplementation could be an indication of increased palatability of cowpea to Yankasa rams. This is in consistence with the previous work of Nuwam (2015) who reported supplementation with legume forage significantly enhance feed intake in ruminants such as red Sokoto does. Also, groundnut supplementation enhances feed intake and performance of ruminants as stressed by Okafor *et al*. (2012).

Koralagama *et al.* (2008) fed Ethiopian sheep with basal maize stover supplemented with cowpea hay (150g and 300g/day) reported a higher nutrient intake and live weight gain. The intake of rice straw was highest for the control group which was not supplemented. This is expected probably due to the poor quality of the nutrient contents; animals tend to consume more in order to probably meet up the nutrient demands of the body. The high feed intake reported in the present study may be attributed to feed palatability, animal preference or high rate of degradation of cowpea and groundnut haulms. This agrees with the report by McMeniman *et al*. (1988) that supplementation of legumes to low quality roughage increase intake as well as nutrients digestibility. Feed intake increases with legumes supplementation. This conforms to the work of Yashim *et al*. (2016) in goats. Significant improvement in feed intake and digestion of most nutrients reported in this study due to supplemented feeding of cowpea hay group could be justified by the relatively better intakes of CP. The result of cowpea hay, groundnut haulms and combination are indicative of the high value of these feeds. This is in line with the finding of Bosman *et al*. (1995) and Mero and Uden (1998). The combination of cowpea and groundnut haulms and some amount of rice straw can be used to determine the optimum combination of the two classes of feeds. The variations observed in the intake for the different treatment groups could probably be attributed to the different type of supplements offered.

Cowpea hay and groundnut haulms supplementation significantly increased the live weight gain and average daily weight gain across all supplemented groups compared to the control. The response obtained are indicative of the quality of cowpea and groundnut haulms. The trend in live weight changes obtained from animals on supplemented groups of both cowpea and groundnut haulms and their combination showed an increasing tendency attributed to the fodder. This study is in agrees with the previous findings by Anele *et al*. (2010), Abdou *et al*. (2011) and Osafo *et al*. (2013). All rams fed rice straw supplemented cowpea and groundnut haulms had increase in average daily weight gain. This finding is also similar to that reported by Abil *et al.* (1992). This indicated that supplementation with cowpea and groundnut haulms improve feed conversion ratio of the ruminants and hence could enhance the growth of the rams. Feed to gain ratio were

lower in treatment II and IV indicating that animals in these treatments were more efficient in utilization of feeds. This finding agrees with that of Maigandi and Nasiru (2006) who reported improvement for feed conversion ratio of 7.60 among Uda sheep fed using *Faidherbia albida* pods supplements.

The decrease in cost of feed/kg weight gains of the supplemented feeds reported in this study implies that, cowpea hay and groundnut haulms supplementation to basal rice straw influence the cost of feed/kg gain in Yankasa rams. There is marked reduction in feeding cost with cowpea hay and groundnut haulms supplementation. This finding is in conformity with work of Maigandi and Bibi-Farouk (2008) who reported reduction in the cost of feeding with supplementation by pods of *faidherbia albida* in the diet of fattening and growing Uda sheep. They reported reduction in cost of feed from N869.3 from the control to N162.9 for the supplemented diet. This finding is in conformity with the work of Komwihanglo and Mlela (2012) who reported that, feeds supplementation with legumes reduced the cost of feeding in ruminants. Similar finding was found in the work of Yashim (2016) who reported reduced cost of feeds with supplementation of *Ficus sycomorus* in Yankasa rams from ₦232.86 to ₦129.48.

CONCLUSION

It was concluded that supplementation improved the growth performance of Yankasa rams by 8.63 kg and 8.0 kg respectively in comparison to 5.25 kg of the control. Cost of feed per kg live weight gain was lower in rams fed cowpea hay at 300g /day (₦1451.20/kg) followed by groundnut haulms at 300g /day (₦2539.62/kg). Cost of feed per kg live weight gain was lower and better on cowpea hay at 300g /day.

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