PERFORMANCE AND GROSS MARGIN ANALYSIS OF YANKASA RAMS FATTENED ON VARYING LEVELS OF A DIET CONTAINING DRY LAYER LITTER

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ABSTRACT

Dry layer litter (DLL) was used to substitute cottonseed cake (CSC) in intensive ram fattening study in attempt to reduce the cost of production. Twenty four (24) Yankasa rams aged 24-30 months and weighing 33.0±3.0 kg were assigned to 4 treatments in a completely randomized design, 6 rams by treatment and individually fed. The concentrate was offered at 1.0, 1.5, 2.0 and 2.5 % of body weight (BWT) respectively followed by chopped maize stover at 2.0 % of BWT across the treatments. Water was provided *ad libitum* throughout the study period of 112 days. Digestibility trial was conducted during the last 14 days of fattening study. Rams were weighed weekly and the weights were used to adjust the level of feeding accordingly to reflect percent of BWT. Weight changes were recorded separately for each ram. Gross margin analyses were done to determine feed cost per gain, value of gain and income over feed cost. All data were subjected to statistical analysis using the GLM of SAS (1998). Results indicated the ADG to be 73.84, 101.87, 140.18 and 137.68 g/head/day at 1.0, 1.5, 2.0 and 2.5 % of BWT feeding of the concentrate respectively. There were no significant differences ($p>0.05$) between 2.0 and 2.5% levels of concentrate feeding. Dry matter and CP digestibility were significantly different ($p<0.05$) between the control and 2.5 % level. Crude fibre digestibility decreased with increased level of feeding. Gross margin analysis showed that there was no significant difference ($p>0.05$) in feed cost per gain between 1.0 % and 1.5 % levels. Feed cost per gain was significantly lowest at 2.0 % level. There was no significant difference ($p>0.05$) in value of gain between rams fed the concentrate at 2.0 % and those fed at 2.5 % of BWT. Income over feed cost was significantly highest ($p<0.05$) at 2.0 % level of concentrate feeding. It can be concluded that feeding rations in which DLL replaced CSC to fatten rams at 2.0 % of BWT resulted in the best performance and the highest income over feed cost.

Keywords: Performance, Gross margin analysis, Dry layer litter, Yankasa rams

INTRODUCTION

One major aspect of sheep production is to increase the body weight of mature sheep through fattening which will ultimately result in increased mutton production. In Nigeria, farmers fatten rams in order to meet demands during ceremonies such as 'Eid-el-Kabir' ('Sallah'). Fattened rams command premium

during this period. The use of grains for fattening is not common due to high cost of the grains and competition with humans and monogastric animals. Agro-industrial by-

products such as maize offal and poultry litter which are comparatively cheaper than the conventional feedstuffs (e.g. maize, cottonseed cake and groundnut cake) are currently being used in ram fattening operations. However, these non-conventional feedstuffs are not fed in a systematic manner which can be replicated.

The results of the growth trial show that sheep fed diets in which dry layer litter replaced all the cottonseed cake in the concentrate performed better than those containing various levels of cottonseed cake. The objective of the present trial is to further investigate this concentrate diet by studying the effect of level of feeding on the performance of fattening rams and to determine the economics of returns of feeding concentrate containing dry layer litter and maize offal.

MATERIALS AND METHODS

Location:

The experiment was conducted at the Experimental Unit of the Small Ruminants Research Programme, National Animal Production Research Institute, Ahmadu Bello University, Shika-Zaria. The location of Shika has been described by Osinowo *teal.* (1991), Akpa (1999). Shika is located in the Northern Guinea Savanna on latitude 11^0 12' N, longitude 7^0 33' E, altitude 610 m. Annual rainfall is 1100-1200 mm while mean temperature is about 24.4^0 C ($14.5\text{-}39.5^0$ C) with the lower temperatures occurring during the early dry season (November-January) while the higher temperatures are experienced during the late dry season (February-April).

Feed preparation:

The basal diet of maize stover was collected in October 2002, chopped and kept until used. The ingredients used for compounding the concentrate diet are maize offal, dry layer litter, bone meal and common salt. The maize offal, bone meal and common salt came from NAPRI Feed Store while the dry layer litter was supplied by the Poultry Research Programme of the Institute. The concentrate supplement was compounded as in the growth study and contained 2.60 Mcal ME/kg and 14 % CP. Tables 4.1 and 4.2 show the ingredient composition and chemical composition of the concentrate feed ingredients respectively. Table 4.3 shows the chemical composition of the compounded diet.

Animal management, experimental design, feeding, measurements and data analysis:

Fattening trial

Twenty four (24) Yankasa rams aged 24-30 months and weighing 33.0 ± 3 kg were used in this trial. The rams were dosed with antihelmintic (Albendazol) and antibiotic (Terramycin L/A) as prophylaxis 7 days to commencement of fattening. The experimental treatment consisted of feeding the concentrate at 1.0, 1.5, 2.0 and 2.5 % of body weight of the rams. The 24 rams were assigned to the treatments in a completely randomized design, 6 rams by treatment and individually fed. The concentrate ration was offered first in the morning and

chopped maize stover was then offered at 2.0 % of BWT. Water was provided *ad libitum* during the experiment which lasted for 112 days.

At 7.00 hrs, leftover concentrate, roughage and water were weighed and recorded separately. The difference between quantity offered and that refused was recorded as intake. Thereafter, the rams were fed the daily ration and watered. The rams were weighed weekly. Change in weight was recorded as the difference in weight between one week and the next. Weekly weights of the rams were used to adjust the quantities of feed offered in order to maintain the pre-determined levels of feeding. Final weight changes were determined by deducting initial weights from final weights at termination of the feeding trial. Body condition score was done as recommended by Pullan (1978).

Digestibility trial

Digestibility trial was conducted during the last 14 days of fattening study. Three rams were used per treatment. Seven days adjustment period was followed by 7 days total collection of faeces and urine. Ten percent of each day's total dried faeces of each ram was bulked and kept in air-tight container until required for analysis. Ten ml dilute (0.01 N) HCl was introduced into the container before placing it for urine collection for the purpose of 'trapping' NH_3 in urine. Ten % of the urine from each ram was saved in a deep freezer until required for analysis. Samples of the concentrate and roughage offered during the metabolism trial were collected separately for analysis.

Laboratory analyses:

Laboratory analyses of feed and faeces for DM, CP, OM and ash were determined using proximate analyses (AOAC, 1996). Crude fibre, NDF and ADF were determined using the procedure of Van Soest and Robertson (1988). Bomb calorimeter was used to determine the Gross energy while urine N was determined using Micro Kjeldal method.

Economic analysis:

Market surveys were done in Zaria and its environs to determine the cost of rams and feed. Information from the surveys was used to work out feed cost per gain, value of gain and income over feed cost.

Data analysis:

Data were subjected to ANOVA using the GLM of SAS (1998). Treatment means were separated using Duncan's Multiple Range Test (Steel and Torie, 1960).

RESULTS

Ingredient and chemical composition of concentrate diet:

Ingredient composition of the concentrate shows that the diet contained 74 % MO and 24 % DLL (Table 4.1). Table 4.2 shows the chemical composition of feed ingredients used for compounding rations for the fattening rams. The DM

contents of DLL and MO were similar and lower than that of MS. The OM contents of the three ingredients differed with DLL having the lowest and MS the highest values. There were marked variations in the CP contents. Dry layer litter contained slightly

more than twice the amount of CP in MO and about six times that in MS. Maize stover recorded the highest CF content followed by DLL and then MO. Ether extract was similar for DLL and MO while NFE was highest for MO and lowest for DLL. The NDF and ADF values were higher for DLL than for MO. Maize stover had the highest values with respect to these two parameters. The Ca and P contents of DLL were four and two times those of MO respectively. Maize offal had lower Mg content than DLL though the value was similar to that of MS. The difference in K content between DLL and MO was 0.2 with DLL recording the higher value. Maize stover contained the highest amount of K. There were marked differences in energy contents of the feed ingredients; Gross Energy (GE) was least for MS followed by DLL and then MO.

The chemical composition of the concentrate diet is shown in Table 4.3. Crude protein was 14.57 % while GE was 2.51 Mcal/kg. The CP and GE values of MS were 3.98 % and 0.27 Mcal/kg respectively.

Fattening trial:

Table 4.4 shows feed intake, weight gain, efficiency of feed conversion, body condition score and water consumption of the fattening rams. Concentrate intake increased with increasing level of concentrate on offer. However, the difference between rams receiving 2.0 and 2.5 % levels was not significant ($p>0.05$). Maize stover intake decreased with increased level of concentrate offered although there was no significant difference ($p>0.05$) between the 1.5 and 2.0 % levels. Total feed intake was significantly ($p<0.05$) lower for rams fed the concentrate diet at 1.0 % of BWT than those fed at 1.5, 2.0 and 2.5 % of BWT. Intake was not different in rams fed at 2.0 and 2.5 % of BWT. The trend shows that increasing the level of feeding resulted in increase in feed intake. Dry matter intakes as percent of BWT were not significantly different ($p>0.05$) between treatments except at 1.0 % level which was significantly lower ($p<0.05$) than that of the other treatments. Similarly, there were no significant differences ($p>0.05$) in DMI when the live weights of the rams were converted to metabolic weights ($W^{0.75}$). Increasing the level of feeding had no effect on DMI/$W^{0.75}$. Average daily gains of rams fed at 1.0 % of BWT was significantly lower ($p<0.05$) those fed at 1.5, 2.0 and 2.5 % of BWT. Increasing the level of feeding resulted in progressive increase in ADG although there was a slight drop in ADG at the 2.5 % level of concentrate feeding which was not significant ($p>0.05$). Feed efficiency (i.e. feed: gain) was poorest in rams fed at the lowest level, which was significantly different ($p<0.05$) for rams fed at 1.5 % of BWT. Feed was better utilized ($p<0.05$) by rams fed at 2.0 and 2.5 % of BWT than rams fed at the lower levels but were not different between themselves. There was a trend towards better feed utilization as level of feed intake increased but dropped at the 2.5 % level of concentrate feeding. Body condition score generally improved with increase in level of feeding but with a slight decline at the 1.5 % level of concentrate feeding at termination of the trial. There were no significant differences ($p>0.05$) in body condition score of the rams both at the beginning and at the end of the study.

Increasing the level of concentrate on offer and consequently total feed intake led to increase in water intake, however the differences were not significant between rams fed at 1.0 % and 1.5 % of BWT. Rams fed at 2.0 and 2.5 % of BWT were not different in

the quantity of water drank but their water consumption was significantly higher ($p<0.05$) than those of rams fed at 1.0 and 1.5 % of BWT.

Digestibility studies:

Table 4.5 shows the results of the digestibility trial. Dry matter digestibility was significantly lower ($p<0.05$) for rams offered the concentrate at 2.5 % of BWT. There were no significant differences ($p>0.05$) in DM digestibility between the rams receiving lower levels of concentrate even though digestibility was highest at 1.0 % level. There was no significant difference ($p>0.05$) in OM digestibility at the higher levels of concentrate intake. There appeared to be no definite pattern in OM digestibility as there was no significant difference ($p>0.05$) between the lowest (1 %) and the highest (2.5 %) levels of concentrate feeding. Crude protein digestibility was significantly lower ($p<0.05$) at 1.0 % level and higher at 2.5 % level. However, there were no significant differences ($p>0.05$) in CP digestibility between the rams fed the concentrate at 2.0 % and those offered the concentrate at 2.5 % of BWT. Crude fibre digestibility decreased with increased level of concentrate feeding although the difference was not significant ($p>0.05$) between 1.0 and 1.5 %, and between 2.0 and 2.5 % levels. There were no significant differences ($p>0.05$) in digestibility of ADF, NDF and hemicellulose across the treatments. Cell wall digestibility was significantly lower at 1.0 and 2.0 % levels.

Gross margin analysis for Yankasa rams fattened on a diet containing dry layer litter:

Table 4.6 shows feed intake, cost of feed consumed, weight gain, feed cost per gain, value of gain and income over feed cost. Concentrate intake increased significantly increased level offered as there were significant differences ($p<0.05$) between all the treatments. Inversely, forage intake decreased as the concentrate on offer increased. The differences in forage intake were significant ($p<0.05$) between treatments. Total feed intake was significantly higher ($p<0.05$) at 2.0 and 2.5 % and lower at 1.0 % of BWT feeding of the concentrate. Cost of feed consumed was significantly different between treatments. It increased with increase in concentrate offered. Weight gain was lowest at 1.0 % and highest at 2.0 % level. Weight gain increased with increase in concentrate intake except at 2.5 % of BWT which recorded a slight decline. Feed cost per gain was significantly lower at 2.0 % level of concentrate feeding. There was no significant difference ($p>0.05$) in feed cost per gain when rams were offered the concentrate at 1.0 % and 1.5 % of BWT. Value of gain increased with increased level of feeding the concentrate. However, there was no significant difference ($p>0.05$) in value of gain at 2.0 and 2.5 % levels. Value of gain was significantly lowest ($p<0.05$) at 1.0 % level. Income over feed cost followed similar trend as value of gain; there were significant differences ($p<0.05$) between treatments. Income over feed cost was significantly lowest at 1.0 % level of concentrate feeding and highest at 2.0 % level. Increased level of concentrate feeding resulted in increased income over feed cost but with a decline at 2.5 % level. Feeding the concentrate at 2.0 % of BWT resulted in the highest income over feed cost.

DISCUSSION

Higher levels of concentrate feeding resulted in higher total feed intake. However, the more the concentrate intake the less the crop residue consumed. The higher level of

roughage consumption by rams offered the concentrate at 1.0 and 1.5 % of BWT was in attempt to make up the gut fill in order to meet the nutrient requirements (Blaxter *et. al.*, 1961; Orskov, 1980; Rai *et. al.*, 1988). All the concentrate offered at 1.0 and 1.5 % of BWT was consumed while 82.0 and 72.8 % of the concentrate was consumed when the rams were fed the concentrate at 2.0 and 2.5 % levels respectively. There was a linear relationship between level of concentrate supplementation and total feed intake. For example, higher levels of concentrate feeding resulted in higher levels of total feed intake.

Body weight gain increased with increased level of concentrate feeding up to 2.0 % of BWT. The increase in ADG with increase in level of concentrate feeding up to 2.0 % of BWT can be explained by increase in nutrient intake and utilization. This can be seen in the trend in feed to gain ratio which improved with level of feeding. The decline in ADG at the highest level of concentrate feeding can be attributed to faster rate of passage of the feed through the GIT and therefore less retention time for digestion and utilization. This agrees with the work of Harmon *et al.*, (1974; 1975) in which lower ADGs were recorded with increased level of feeding similar rations containing poultry litter. This curvilinear trend is also due to the fact that there is an optimum performance and is supported by the works of Harmon *et. al.*, (1974; 1975) and Fontenot (1991). The ADGs of rams offered the concentrate at 2.0 and 2.5 % of BWT were superior to those recorded by Osman *et. al.* (1968) for Sudan Desert Sheep which gained 110 g/head/day when supplemented with a concentrate diet containing similar amounts of protein and energy used in this work. It is likely that the nutrients particularly the minerals in the DLL had a significant effect on nutrient utilization by the Yankasa rams which gained up to 140 g/head/day when fed the concentrate at 2.0 % of BWT. Feed to gain ratio was also lowest at 2.0 % level and highest when the concentrate was offered at 1.0 % of BWT.

Level of concentrate feeding did not have significant effect on body condition score of the fattened rams. At commencement of fattening, the spinal processes of all the rams had a rounded appearance and could not be felt while at the end of the trial all the animals had a solid blocky appearance. The blocky appearance was an indication that the feed was adequate for maintenance as well as for production (fattening) in corroboration with reports in literature (Pullan, 1978; Preston and Leng, 1987; Lamidi, 2005).

Level of concentrate feeding had a significant effect on the quantity of water consumed. Rams offered the concentrate diet at 1.0 and 1.5 % of BWT consumed 3.0 litres of water/head/day while rams fed the supplement at 2.0 and 2.5 % of BWT had water intakes of up to 4.0 litres/head/day. This agrees with earlier reports that high concentrate intakes stimulate animals to drink more water (Blaxter *et. al.*, 1961; Church, 1971; Aganga, 1987).

Weight gain, feed cost per gain, value of gain and income over feed cost are very important parameters in fattening operations (Adu and Brinckman, 1977; Lamidi, 2005). In this study, level of concentrate feeding had significant effect on these three parameters. Rams offered the concentrate at 2.0 % of BWT were superior in terms of

total weight gain and income over feed cost. Feed cost per gain was significantly lowest at 2.0 % of BWT even though the value of gain was not significantly different from that of rams fed the supplement at 2.5 % of BWT. Lamidi (2005) obtained similar results with bulls fed diets in which CSC was replaced with poultry litter. The rams supplemented at 1.0 % of BWT had the lowest values in terms of weight gain, value of gain and income over feed cost followed by the animals offered the concentrate at 1.5 % of BWT. However, feed costs per gain were similar at 1.0 and 1.5 % levels.

CONCLUSION

Feeding rations containing dry layer litter and maize offal to fatten Yankasa rams at 2 % of BWT in addition to chopped maize stover at the same rate resulted in the best performance and the highest income over feed cost.

RECOMMENDATION

Diets containing 24 and 74 % dry layer litter and maize offal respectively are recommended for fattening Yankasa rams at 2 % of BWT in addition to chopped maize stover offered at the same rate for best performance and high income over feed cost.

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Table 1: Ingredient composition of concentrate diet used for fattening Yankasa rams

Ingredients	%
MO	74.0
DLL	24.0
BM	1.5
CS	0.5
TOTAL	100.0

MO = Maize offal; DLL = Dry layer litter; BM = Bone meal; CS = Common salt

Table 2: Chemical composition of concentrate feed ingredients and maize stover used to formulate the concentrate diet.

	Ingredient		
Parameter	**DLL**	**MO**	**MS**
DM,%	91.23	90.14	98.10
OM,%	73.25	81.99	88.61
CP,%	24.89	10.85	4.07
CF,%	17.79	15.36	26.65
EE,%	9.42	8.91	3.13
NFE,%	25.62	52.71	43.19
ADF,%	23.17	19.24	57.62
NDF,%	45.36	29.16	66.13
Ash,%	15.87	6.20	6.38
Ca,%	4.39	0.97	2.32
P,%	1.83	1.11	1.44
Mg,%	2.72	0.19	0.23
K,%	0.57	0.36	2.09
GE, MJ/kg DM	8.13	11.44	1.09

MO = Maize offal; DLL = Dry layer litter; MS = Maize stover

Table 4.3 Chemical composition of concentrate diet and maize stover fed to fattening Yankasa rams

Parameter	Chemical composition, % DM	
	Concentrate	Maize stover
DM,%	94.28	97.77
OM,%	87.65	84.99
CP,%	14.57	3.98
CF,%	12.96	26.69
EE,%	3.88	4.21
NFE,%	36.32	43.21
ADF,%	34.09	54.38
NDF,%	28.24	66.70
Ash,%	5.26	5.81
Ca,%	2.98	2.27
P,%	1.14	1.56
Mg,%	2.02	0.18
K,%	0.39	2.13
GE, MJ/kg DM	10.52	1.13

Table 4.4 Dry matter intake, weight gain, efficiency of feed conversion, body condition score and water consumption of fattened Yankasa rams fed maize stover and a concentrate

Parameter	Concentrate offered, % BWT				
	1.0	1.5	2.0	2.5	SEM
DMI, g:					
Concentrate	323.99^{c}	552.81^{b}	642.75^{a}	698.54^{a}	65.79
Maize stover	617.39^{a}	523.55^{b}	512.10^{b}	457.73^{c}	38.62
Total	941.38^{c}	1076.36^{b}	1154.85^{a}	1156.27^{a}	41.50
DMI,%BWT	2.52^{b}	2.75^{a}	2.78^{a}	2.84^{a}	0.12
DMI, g/W$^{0.75}$	33.58	36.71	37.04	37.87	5.34
Body weight, kg:					
Initial	33.23	33.43	33.72	33.00	0.81
Final	41.50^{c}	44.75^{b}	49.42^{a}	48.42^{a}	2.06
Gain	8.27^{c}	11.32^{b}	15.70^{a}	15.42^{a}	1.87
ADG, g/head/day	73.84^{c}	101.87^{b}	140.18^{a}	137.68^{a}	21.64
Feed: gain ratio	12.75^{d}	10.65^{c}	8.24^{a}	8.40^{b}	0.02
Body condition score:					
Initial	3.70	3.80	3.78	3.65	0.17
Final	4.80	4.78	4.85	4.88	0.15
Water consumption, litre/head/day	2.97^{b}	3.25^{b}	3.58^{a}	3.61^{a}	0.29

^{abcd} **Means in the same row with similar superscripts do not differ significantly at P>0.05; NS = Not significant**

Table 4.5 Apparent digestibility of DM and nutrients by fattening Yankasa rams fed graded levels of a concentrate containing dry layer litter

Parameter	Concentrate on offer, % BWT				
	1.0	1.5	2.0	2.5	SEM
DM,%	69.41[a]	68.25[a]	68.37[a]	64.15[b]	2.19
OM,%	44.65[a]	40.34[b]	41.40[b]	42.79[ab]	3.06
CP,%	65.92	68.88	71.34	70.56	9.24
NDF,%	28.61	27.91	24.63	30.28	6.57
ADF,%	14.64	12.26	13.76	15.02	5.21
Cell wall,%	22.72[b]	26.30[ab]	21.44[b]	31.84[a]	7.36
Hemicellulose	43.18	52.50	41.27	39.05	13.97

[abcd] Means in the same row with similar superscripts do not differ significantly at p>0.05

Table 4.6 Gross margin analyses for fattened Yankasa rams fed maize stover and a concentrate containing dry layer litter and maize offal.

Parameter	Concentrate on offer, %BWT				
	1.0	**1.5**	**2.0**	**2.5**	**SEM**
Total concentrate intake, kg	41.85[d]	65.67[c]	76.36[b]	82.98[a]	3.38
Total forage intake, kg	70.92[a]	59.97[b]	58.66[b]	52.44[c]	5.64
Total feed intake, kg	112.57[c]	125.64[b]	135.02[a]	135.42[a]	7.16
Cost of feed consumed, ₦	666.24[d]	943.44[c]	1074.88[b]	1145.45[a]	23.52
Weight gain, kg	8.27	11.32	15.70	15.42	
Feed cost per gain, ₦	80.56[a]	83.34[a]	68.46[b]	74.28[c]	4.75
Value of gain, ₦	1240.50[c]	1698.00[b]	2355.00[a]	2313.00[a]	64.07**
Income over feed cost, ₦	574.26[d]	754.56[c]	1280.12[a]	1167.55[b]	57.60**

[abcd] Means in the same row with similar superscripts do not differ significantly at P>0.05; NS = Not significant; * = Significant at 5%; ** = Significant at 1%

Cost of maize offal =N15,000 per ton
Cost of cottonseed cake =N20,000 per ton
Cost of dry layer litter =N 6,000 per ton
Cost of collating and transporting maize stover =N2,000 per ton
Value of gain = weight gain * N150 (cost of live animal/kg)