Sahel J. Vet. Sci. Vol. 9, No. 2, pp. 5 - 9 (2010)

1605-8954/10/$25.00 + 00

Sahel Journal of
Veterinary Science

Effects of Cotton Seed Cake and Dry Poultry Litter Supplementation on Performance of Grazing Sheep in the Sahelian Zone of Nigeria

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ABSTRACT

Twelve Yankasa male sheep aged 12 - 18 months with a mean live weight of 29 ± 1.04 kg were used to determine the effects of supplementing cotton seed cake (CSC) (DPL) and dry poultry litter on performance and growth rate. The design was 3 × 4 latin square. The mean dry matter intake (DMI) were 1.22 and 1.26 kg/day for T_1 (CSC) and T_2 (DPL) respectively. There was significant difference between the supplemented groups and the control group. The dry matter digestibility (DMD) data were 68.5, 69.9 and 54.4% for T_1(CSC), T_2(DPL) and T_3(Control) respectively. There was a significant difference between the supplemented groups and the control group. The corresponding live weight changes were 13.0, 15.37 and 6.60 g/day. Animals fed with dry poultry litter (DPL) showed a significantly higher daily live weigh gain. Result of nitrogen intake, nitrogen in faeces, and nitrogen in urine were 29.9, 30.1 and 15.1; 15.5, 13.1 and 7.1 and 3.7, 6.7 and 4.7 for T_1(CSC), T_2(DPL) and T_3(Control) respectively. The result showed that poultry litter could substitute cottonseed cake as source of Nitrogen for rumen microbes with a resultant increase in live weight.

Key words: Sheep, cottonseed cake, dry poultry litter, grazing

INTRODUCTION

Poor nutrition especially during the dry season is one of the major factors militating against livestock production in Borno State. It has been estimated that Borno State alone produces 40% of the nation's livestock trade (Alaku and Igene, 1986). This is substantial and of great importance to the nations livestock industry. It has however, been observed that protein supplements are both scarce and costly especially in developing countries and their future use for ruminant appears even uncertain (Aganga *et al.,* 1983). This is because grains, which form the bulk of the supplementary feed for ruminants, are in short supply resulting in high cost. In addition, there is demand of grains by human for food.

Cottonseed cake as a supplement to livestock has become very important in many countries of tropical Africa following considerable development in livestock nutrition in the last few decades. In terms of average values, cottonseed cake is a feed stuff that has reactively high content of protein (15 -30%), fat (10 - 23%) and cellulose (25 - 30%), much of which is completely digestible (CAB, 1992). Concentrate feeds are valued on their energy and protein quality. This feed ingredient is expensive because of their special value as pig and poultry feeds.

The utilization of poultry waste as supplement to livestock has attracted considerable research attention especially in the developed countries of the West. Several reports tend to indicate that poultry waste has been successfully fed to cattle (Allison, 1985; Alhassan *et al.,*1986). Dried poultry waste (DPW) is an effective and valuable nitrogen supplement in ruminant diets (Kibon and Abbator, 2002). The utilization of this by-product or waste materials in animal feeding is stimulated by the economy of disposing these wastes, reducing its potential as environmental pollutant and the use as a manure for crop production and its potentials as livestock feeds and (Chesworth, 1992). The nutritive value of animal excreta is greatly influenced by the specie of animal and the diet consumed (CAB, 1992). Poultry waste is variable in composition, resulting partly from differences in management style in place and also from subsequent treatment of the materials before use. Poultry waste contains 24-33% crude protein, 5.7 - 30% Uric acid, 2 - 4% fat, 10 - 14%fiber, and 25 - 30%ash content (Danjuma, 1988).

The objective of this study therefore was to study the effects of supplementing cottonseed cake and dried poultry waste (DWP) on the performance of grazing sheep.

MATERIALS AND METHODS

Twelve Yankasa male sheep between 12 and 18 months of age and weighing an average of 29 ± 1.04kg were used for this study. A 3 × 4 Latin square design was used for the experiment with four animals per treatment and three weeks per period. The animals were divided into three groups of three animals based on similarity in body weight. Treatment 1 received 0.5 kg of cottonseed cake/animal/day; Treatment 2 received 0.5 kg of dry poultry litter/animal/day and Treatment 3 was only grazed without supplementation. The poultry litter was properly sun-dried, the common treatment methods used in Borno State, Nigeria. All animal were dewormed with Banmith F (Pfizer) and housed in individual pens with free access to water and mineral licks. The study comprised of 14 days of feed adaptation. The animal were allowed to graze from 8:00am to 4:00pm after which they were offered the supplement by 5.00pm. Refusals were collected and weighed before each feeding and sub samples of feed offered were taken during the measurement for chemical analysis. Mineral salt lick and fresh water was offered *ad libitum*. Body weights of the animal were measured at weekly intervals. At the end of the feeding trial, one ram from each treatment was randomly selected and assigned to metabolism cages. Feed, faeces and urine were collected separately. Total urine produced daily was recorded and samples collected in flasks containing 10% sulphuric acid. Faeces was also collected and weighed and sub-samples were taken and kept for chemical analysis using AOAC (2002) method .

Chemical analysis

Samples from the experimental feeds were analyzed for dry matter (DM), crude protein (CP), ether extract (EE), crude fibre (CF), and ash. according to AOAC (2002).

Statistical analysis

The data obtained from the trial were analyzed using analysis of variance procedure for a Latin square design. Standard errors of means were calculated from the mean square in the analysis of variance to detect differences between treatment means (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Chemical composition of the experimental diets

Chemical composition of the experimental diets is presented in Table 1. The result shows that T_1 (cottonseed meal) had the highest crude protein content of 29.74% compared to the other treatments. The ether extract content was highest in cotton seed cake (15.3%) while values of 7.6% and 3.3% were obtained in T_2 (dry poultry litter) and T_3 (zero supplementation) respectively. The crude fibre content of T_2 was higher than the other treatment groups. The ash content ranged from 1.8 to 3.7%. The nitrogen-free extract ranged from 34.84 to 58.2% respectively with T_3 having the highest NFE.

Table 1. Chemical composition of experimental diets (% dry matter)

Ingredient	T_1 (CSC)	T_2 (DPL)	T_3 (control)
Dry matter	93.7	96.7	92.1
Crude fibre	12.0	19.9	12.6
Crude protein	29.74	27.0	16.0
Ether extract	15.3	2.6	3.3
Ash	1.8	3.7	2.0
NFE	34.86	39.2	58.2

CSC = cotton seed cake; DPL = dry poultry litter; control = no supplementation, grazing only

Dry matter intake and digestibility

The result of the dry matter intake (DMI), live weight gain and nutrient digestibility is shown in Table 2. The total DMI were significantly higher ($p<0.05$) for the supplemented groups. Total DMI/head/day was slightly higher in animals supplemented with dry poultry litter (DPL) compared to animals supplemented with cottonseed cake (CSC). The slight decrease in intake of T_1 was similar to the report of Devendra and Mcleroy (1982) who observed that the more extreme the processing treatment, the greater the effect on animal acceptability and hence on voluntary intake. The high DMI observed in T_2 (DPL) may also be due to the palatability of the feed or high protein: roughage ratio (Imam *et al*., 2007). The high DMI for T_2 was also reflected in weight gain of the animals. Poultry litter nitrogen can be utilized efficiently by ruminants especially when the level of litter nitrogen does not exceed 50% of the total nitrogen intake and this subsequently increases the feed intake of ruminants (Ehoche and Roffler, 1982). Sheep uses the nitrogen in broiler litter efficiently when 25 or 50% of the total dietary nitrogen was supplied by the litter (El-Hag and El-Hag, 1981). Poultry litter in addition to supplying nitrogen, may also supply a substantial amount of energy for ruminants.

Table 2. Dry matter intake (DMI), live weigh change (LWC) and nutrient digestibility of sheep offered cotton seed cake (CSC) and dry poultry litter (DML)

	Treatment			
	T_1 (CSC)	T_2 (DPL)	T_3 (Control)	SEM
DMI (kg/day)	1.22^a	1.26^a	0.80^a	0.08*
Faecal output (g/kg)	0.74^b	0.78^a	0.68^a	0.19*
Initial weight (kg)	29.5	28.16	29.33	
Final weight (kg)	42.5^a	43.53^a	35.93^b	1.88*
Live weight change (g)	13.0^b	15.37^a	6.60^a	0.05*

a, b, c ,means within the same row with different superscripts are significantly different (p<0.05). CSC = cotton seed cake; DPL = dry poultry litter; control = no supplementation, grazing only

The faecal output were higher with supplemented groups. The 0.8 kg recorded by the control group was lower than the values for supplemented groups. Sheep weighing 40, 50, 60 and 70 kg live weight have been reported to consume 0.9, 1.0 and 1.2 kg DM daily respectively (El-Sabban, 1970). Grazing behavior of ruminants is complex. Forage intake and selective grazing are functions of numerous pasture and animal characteristics (Flachowsky and Hennig, 1990). Intake has been correlated with forage availability and nutritional quantity (Minson, 1990). Selective grazing is an attempt by ruminants to maximize nutrient intake (French *et al.*, 2001). Energy cost of grazing also are variable and can be substantial (Guy *et al.*, 1981). Such complexity has made prediction of forage intake and animal performance of grazing ruminants very difficult.

The dry matter digestibility (DMD) was higher in T_2(DPL).There was a significant difference (p<0.05) between the supplemented groups and the control group. One of the factors affecting apparent digestibility coefficient was the chemical composition of diets (Eroarome, 2000). The higher the percentage of crude fibre in the forage, the lower the digestibility of other nutrient, but this does not seem to affect animals on diet T_2 (DPL). A possible explanation for this could be as a result of better synchronization of available nutrients (Schafft, 1983). The supplemented poultry litter stimulated the rumen microbes to digest the feed material ingested. It aided in the supply of needed ammonia through the breakdown of uric acid, which is ultimately utilized by the rumen microbes for digestion. The apparent digestibility of poultry litter in T_2 group is within the range 68 - 76% earlier reported by Scafft, (1988).

The crude protein digestibility shows that there was no significant different (p>0.05) between the supplemented groups and the control. This conformed with the report that feed protein and non-protein nitrogen are almost completely degraded to peptides, amino acids and mainly ammonia by rumen microbes (Schncider and Flatt, 1972). These catabolic products especially ammonia, are the main nitrogen source for microbial protein synthesis which is almost entirely dependent on intraruminal energy availability. Thus, the utilization of nitrogen in animal excreta is satisfactory only in combination with a sufficient amount of high energy feeds (Smith and Clavert 1972). Crude protein digestibility of 53% has been reported when dry poultry litter was fed as a sole diet to sheep (Kibon and Abbator, 2002). An increase in apparent digestibility of dry matter (DM), organic matter (OM), crude protein (CP) and nitrogen-free extract (NFE) was reported in Sudan desert sheep when DPL was fed as a supplement to grass hay. The crude protein content of the young herbage may be as high as 14 - 16% which is satisfactory for the needs of sheep and goats weighing over 30 kg (Njidda, 2008). The characteristic growth and development pattern for most tropical grasses including the rapid rise in lignin content with advancing age and the decline in digestibility as maturity approaches, makes it difficult to supply consistently high quality materials needed by grazing animals. This may be attributed to the low nutrient digestibility observed with the control group. This result clearly shows that the available energy in the fresh grass was enough to serve the rumen microbes when offered cottonseed cake or dry poultry waste at the rate of 0.5 kg per day.

The crude fibre digestibility of T_1 (CSC) was higher than T_2 (DPL). There was a significant difference between the treatment groups. The result of the crude fibre digestibility of CSC was supported by the report that indicated a digestion of sizeable portion (55%) of cottonseed cake in the rumen and favorable stimulated the rumen microbes to degrade the ingested fibrous materials (Tomlinson *et al.*, 1996). The crude fibre of T_3 (control) was lower than the supplemented groups. The ether extract digestibility ranging from 42.7 to 53.5%. The ether extract was highly digestible in grass than the supplemented groups.

The result of the live weight gain of the experimental animals shows a significant difference (p<0.05) due to supplementation with either poultry litter or cotton seed cake. Thus the live weights increase in animal supplemented with either poultry litter or cotton seed cake compared to the unsupplemented or control group. The gain was however, higher in animals supplemented with poultry litter. Higher live weight gain observed in poultry litter supplemented animals was possibly due to higher DMI. The higher live weight gain in T_2 also conformed with the assertion that sheep fed with chicken litter as a protein supplement perform as well as those fed soya bean meal

(Ehoche and Roffler, 1982). The use of poultry litter as feed to ruminants on roughage-based resulted in improved daily weight gain (Kibon and Abbator, 2002). Alhassan *et al*. (1986) also reported that feeding higher quantity of CSC alters rumen pH and reduces the cellulotic activity of rumen microbes. This may be the reason why animals on CSC has less weight compared to those on DPL.

The result of nitrogen balance trial showed significant difference ($p<0.05$) in terms of Nitrogen in faeces , urine and absorbed (Table 3). There was a significant effect of CP level on nitrogen intake. The major effect was on urinary-N output. Apparent faecal-N output was not affected by CP level (Table 4). A 77% increase in N excretion was observed when CP concentration increase from 120 to 180 g/kg DM without corresponding increase in energy level (Wilson and Brigstocke,1981). This was reflected in the higher amount of N that was retained by the supplemented group compared to control group. An average nitrogen retention of 30% in yearling rams fed DPL was indicated (Anthony, 1967). It is therefore necessary that when supplement are being formulated for sheep the ratio of protein to energy is of utmost importance to obtain the highest level of efficiency.

Table 3. Nutrients digestibility of sheep offered cottonseed cake, dry poultry litter and grazed on natural pasture

	Treatment			
Nutrient(%)	T_1 (CSC)	T_2 (DPL)	T_3 (Control)	SEM
Dry matter digestibility	68.5^a	69.9^a	54.4^b	2.08*
Crude protein digestibility	59.4^a	64.5^a	49.1^b	3.10*
Crude fibre digestibility	69.0^a	59.2^b	49.0^c	3.00*
Ether extract digestibility	42.7^b	50.9^a	53.5^a	2.90*

a, b, c, means within the same row with different superscripts are significantly difficult ($p<0.05$).SEM=standard error of means; CSC= cotton seed cake; DPL= dry poultry litter; control = no supplementation, grazing only

Table 4. Nitrogen utilization (g/day) of sheep fed cottonseed cake, dry poultry litter and grazed on natural pasture

	Treatment			
	T_1 (CSC)	T_2 (DPL)	T_3 (Control)	SEM
Nitrogen intake	29.80^a	30.10^a	0.18^b	1.11*
Nitrogen in faecal	15.50^a	13.10^b	0.10^c	0.62*
Nitrogen in urine	5.10^a	6.70^a	0.05^c	0.04*
Nitrogen retained	9.20^b	10.30^a	0.03^c	0.01*
Nitrogen absorbed	14.50^b	17.00^a	0.05^c	0.01*
Nitrogen absorbed as % of nitrogen intake	31.20^a	34.2^a	0.13^b	1.23*
Nitrogen retained as % of nitrogen intake	30.87^b	34.22^a	16.67^c	1.01*

a, b, c, means within the same row with different superscripts are significantly different ($p<0.05$).SEM = standard error of means; CSC= cotton seed cake; DPL = dry poultry litter; control = no supplementation, grazing only

CONCLUSION

It can be concluded that feeding poultry litter as supplement to grazing sheep was better in terms of performance and growth rate than cottonseed cake. Therefore poultry litter from broiler can substitute cottonseed cake as protein supplement for Yankasa sheep.

REFERENCES

Adu, I. F. and Lakpinim, C. A. M. (1983). The utilization of dried poultry waste as protein supplement for growing Yankasa sheep. *J. Anim. Prod. Res*. 3, 49-56.

Aganga, A. A., Umanna, N. N. and Chineme, C. N. (1983). Requirement and utilization of nitrogen by ruminants. A review *J. Anim. Prod Res*. 3(2), 139-154.

Alaku, S. O. and Igene, I. O. (1986). Factors influencing trade movement of sheep and goats from Brono State to other parts of Nigeria. *Ann. Borno* 3, 127-136.

Alhassan, W. S., Ehoche, O. W and Adu, I. F. (1986). Influence of graded levels of cotton seed cake supplementation on the nutritive value of cereal straw by sheep and goats. *J. Anim. Prod. Res*. 6(1), 39-53.

Allison. C. D. (1985). Factor affecting forage intake by range ruminants: A review. *J. Range Manag.* 38, 305.

Anthony, W. B. (1967). Review of studies of feeding poultry litter to livestock poultry litter. Seminar, Auburn University, Auburn, Texas, USA. pp. 121-135.

AOAC (2002). *Official Methods of Analysis of the Official Analytical Chemists*, 17th ed. (Horwitz, W., ed). Association of Official Analytical Chemists, Washington D.C., U.S.A.

Chesworth, J. (1992). *Ruminant Nutrition*. The Tropics Agriculturist, CTA Macmillan, London and Basinstoke.

Commonwealth Agricultural Bureaux (CAB)(1992).*International Manual of Sheep Production in the Humid Tropics of Africa*. Translated by Alan Leeson. pp. 52-57.

Cordova, F. J. Wallace J. D. and Pieper R. D. (1978). Forage intake by grazing livestock: a review. *J. Range Manag* 31, 430.

Danjuma, D. (1988). Dry poultry waste in the diets of Borno white goats. Unpublished M. Sc. Dissertation, University of Maiduguri, Maiduguri, Nigeria.

Devendra, C. and Mcleroy, G. B. (1982). *Goat and Sheep Production in the Tropics*. Intermediate Tropical Agricultural Series, Longman Publishers, London. pp. 178-193.

Ehoche, O. W. and Roffler, R. E. (1982). The proportion of supplemental protein escaping degredation in the rumen of cattle. *J. Anim. Prod. Res*. 2(1), 11-24.

El-Hag, M. G. and El-Hag, G. A. (1981). Further studies on the effects of supplementing groundnuts with hulls dried poultry excreta or cotton seed cake on performance of Sudan desert sheep. *Wrld Rev. Anim. Prod*. 17, 9-14.

El-Sabban, F. F, Bratzler, J., W., Long, T. A. and Fear, D. E. (1970). Value of processed poultry waste as feed for ruminant. *J. Anim. Sci*. 31, 107-111.

Eroarome, M. A. (2000).Chemical composition and nutritive value of some Tropical by-product feedstuffs for small Ruminants. *In vivo* and *in vitro* digestibility. *Anim. Feed Sci. Tech*. 85, 99-109.

Flachowsky, G. and Hennig, A.(1990). Composition and digestibility of untreated and chemically treated animal excreta for ruminants: A review. *Biol. Waste* 31, 17-36.

French, P. O., Riordan, E. G. O., Kiely, P, Caffrey, P. J. and Moloncy, A. P.(2001) Intake and growth of steers offered different allowances of autumn grass and concentrates. *Anim. Sci.* 72, 129-138.

Guy, M.C., Watkin B. R. and Clark D. A. (1981). Effects on season stocking rate and grazing duration in diets selected by hoggets grazing mixed grass-clover pastures, *N.Z. J. Exp. Agric*. 9, 41.

Holzer, Z. and Levy, D. (1976). Poultry litter as a protein supplement for beef cows fed fibrous diets. *Wrld Rev. Anim. Prod*. 12(1), 91-95.

Imam, A.B., Njidda, A. A. and Kibon, A. (2007). Comparison of cotton seed cake and poultry litter as protein sources in the diets of growing wadara cattle fed basal diet of sorghum stover in semi arid region of Nigeria. *Global J. Agric. Sci*. 6(2), 191-194.

Kibon A. and Abbator, F. I. (2002). Utilization of dried poultry litter for ram fattening in the semi-arid region of Nigeria. *J. Arid Agric.* 12, 145-148.

Mc Donald, P., Edwards, R. A. and Green halgh, J. F. D. (1987). *Animal Nutrition,* 4th ed. Longman Group (FE) Ltd., Hong Kong. pp. 37-39.

Minson, D. J. (1990). *Forage in Ruminant Nutrition*. Academic Press, San Diego, USA. 483pp.

Njidda, A. A. (2008). The effect of protein and energy supplementation on the growth performance of growing sheep during the wet season. *Nig. J. Exp. Appl. Biol*. 9(1), 17-22.

Schaff, H., Rohr. K. and Lebzien, P. (1983).Untersuchungen Uber den intaruminalen aaAbbau Von Heu-und Getredeprotein; Z., Tierphsiol., TIERENAHRG U, *Futtermittelkde*. 50, 34-36.

Schaff., H., Zorita., E., gadeken, D. and Oslage, H. J. (1988). Nitrogen metabolism in sheep as related to energy supply; In: *Protein Metabolism in Sheep as Related to Energy Supply*; *Proc. 5th Intern. Symp. On Protein Metabolism and Nutrition*, Rostock. 1987; EAAP Publ. No. 35: Wiss. Z. WPU Rostock. N-Reihe. 37(2), 102-103.

Schneider, B. H and Flatt, W. P. (1972). *The Evaluation of Feed Through Digestibility Experiment*. University of Georgian Press, Athens, USA.

Smith, L. W. and Clavert, C. C. (1972).Dehydrated poultry wastes in rations of sheep. *J. Anim. Sci*. 35, 275 (Abstr).

Steel, R. G. D. and Torrie., J. H. (1980). *Principles and Procedure of Statistics*. McGraw-Hill, New York, pp. 137 -219.

Tomlinson, A. P., Powers, W. J., Van Horn, H.H., Nordstedt R.A. and Wilcox, C. J. (1996). Influence of supplemented energy and protein on the performance of West African Dwarf sheep. In: Ogunji, J.O., Osakwe, I. I., Ewa, V. U., Alaku, S. O., Otuma, M. O.and Nweze, B. O. (eds). *Proc. of the 9th Ann. Conf. Of Animal Sci. Assoc. of Nig*. 13th -16th September 2004. Ebonyi State University, Abakaliki, Nigeria. pp. 130 -132.

Wilson, P. N. and Brigstocke, D. A. (1981). *Improved Feeding of Cattle and Sheep*, 1st ed. Longman Publishers, London. pp. 23-24.