

Supplementation of grass hay with groundnut haulm and sorghum bran substituting cottonseed cake.

0. I. Kurdi * and E. M. El-Amin *Agricultural Research Station, El-Obeid, Sudan.*

SUMMARY

The effect of using groundnut haulm and sorghum bran as supplements to native hay and their substitution to cottonseed cake was investigated. Thirty rams were used in a 5X6 random design, with five animals per treatment. The animals were 1.0 – 1.5 year in age and 34.0 – 35.1 kg in weight. The experiment lasted for 75 days. The digestion of all nutrients was depressed when cottonseed cake, groundnut haulm and sorghum bran were added individually or in combination to native hay. Sorghum bran significantly ($p < 0.01$) depressed protein digestibility while all the supplements, with the exception of groundnut haulm, significantly ($p < 0.01$) depressed fibre digestibility. Groundnut haulm improved fibre digestibility when combined to both cottonseed cake and sorghum bran in one supplement. All supplements significantly ($p < 0.05$) increased total dry matter intake while they significantly ($p < 0.01$) depressed native hay intake. The daily gain and feed efficiency were all improved by supplementation. The cost of supplementation was clearly reduced when sorghum bran and groundnut haulm were added to cottonseed cake.

INTRODUCTION

Small ruminants play prominent role in the life of sedentary farmers in Western Sudan. They represent an important complementary component in the agricultural production system. However, these animals, almost entirely depend on natural grazing. During the rainy season range pastures provide adequate feed to support the animals and allow for satisfactory level of production. Late in summer, pastures dry up and the available herbage can

* Present address : University of Gedaref; Gedaref – Sudan.

hardly meet the maintenance requirements of the animals. In fact, the CP content of the standing hay range between 3 – 6% and it's ADF may some time exceed 70%. The inadequacy of nutrient supply during this period is clearly reflected on the apparent bodyweight losses and the increase of mortality rate. Supplementation of the standing hay is therefore necessary for the survival of animals. Traditionally, oil cakes and grains are used for this purpose. Today, small farmers can hardly afford the increasing prices of oil cakes. Moreover, and because of the recent drought, sufficient grains are no longer available as animal feed at the level of the village.

A recent work emphasized the need of using legume hay as supplement by subsistence farmers (McMeniman et al. 1988). In North Kordofan, groundnut is usually grown by most of the villagers. After harvest the haulm constitutes a good source of animal feed and, being a legume, its relatively high nutritive value can supplement native grass hay late in the dry season. The expanding milling industry in this region also offers another cheap and nutritious supplement in form of bran.

The purpose of this research work was the evaluation of groundnut haulm and sorghum bran as supplements to native hay and the investigation of their substitution to oilseed cakes at the village level.

Thirty rams (Sudan desert sheep), all about 1 to 1.5 years old and weighing 34 to 35 kg were used in a 3X6 complete random design. Five animals were used per treatment. The six treatments were :

MATERIALS AND METHODS

Treatment 1: constituted of native hay offered ad libitum. The hay consisted of four species; *Pennisetum ramosum*, *Hyparrhenia spp.*, *Cymbopogon nervatus* and *Brachiaria obtusiflora*.

In treatment 2, 3 and 4 the sheep were fed 0.5 kg per head per day of each cottonseed cake, groundnut haulm and sorghum bran respectively and after the supplement had been consumed the animals were given native hay ad libitum.

In treatment 5 the sheep were given a combination of both cottonseed cake and sorghum bran at a rate of 0.25 kg of each supplement per head per day. Native hay was offered ad libitum.

In treatment 6, the sheep were given a combination of the three supplements; cottonseed cake, sorghum bran and groundnut haulm at the rate of 0.167 kg of each supplement per head per day. Native hay was also offered ad libitum.

The animals were kept in individual pens and were individually fed and watered. Supplements were weighed and offered once a day and refusals

were collected just before offering the next day's feed, weighed and then dried. The experiment lasted for 75 days and the animals were weighed every other week.

After the end of the feeding trial, three animals from each treatment were selected and equipped with harnesses and bags for faecal collection and digestibility measurement of the six diets. During the digestibility trial water was offered free choice.

Dried samples of feed, refusals and faeces were ground in a laboratory mill (Christy Norris) using a 0.8 mm sieve. The proximate analysis was carried out according to the official method of the Association of Official Agricultural Chemists (AOAC, 1975).

The data was tested for statistical significance by the analysis of variance according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

The ingredients of the six diets and the chemical composition of the three supplements and the native hay are given in Table 1. The three supplements, compared to native grass hay, were all high in protein content while the fibre content was low in sorghum bran and high in the other two supplements. Native hay was high in fibre content but low in protein.

Table 2 shows that the digestion of all nutrients was depressed when the three supplements were added individually or in combination to native hay. The protein digestibility of animals fed native hay was higher than that fed native hay plus any of the supplements. When sorghum bran was added to native hay, protein digestibility was significantly ($p < 0.01$) depressed. The results also showed that, with the exception of groundnut haulm, all other supplements significantly ($p < 0.01$) depressed fibre digestibility when added to native hay. Groundnut haulm improved fibre digestibility when added to both cottonseed cake and sorghum bran. Table 3 indicates that while supplementation of native hay significantly ($p < 0.01$) increased total dry matter intake, it also significantly ($p < 0.01$) depressed native hay intake. In terms of liveweight gain and feed efficiency, all supplements were comparable to cottonseed cake except groundnut haulm which showed the least improvement.

Table (1): Influence of season on pre-and post-freezing sperm motility of Kenana bulls diluted with Tris and sodium citrate based extenders.

Season	Extender	Initial motility (%)	Post-thawing motility
		(%)	(%)
		Mean $\pm$ SD	Mean $\pm$ SD
Autumn	<u>Tris</u>	72.92 $\pm$ 6.85 ^a	69.06 $\pm$ 2.31 ^a
	Sod. <u>citrate</u>	68.72 $\pm$ 3.33 ^b	57.75 $\pm$ 4.21 ^b
Winter	<u>Tris</u>	77.41 $\pm$ 9.32 ^a	69.50 $\pm$ 3.07 ^a
	Sod. <u>citrate</u>	71.39 $\pm$ 8.38 ^a	55.12 $\pm$ 7.12 ^b
Summer	<u>Tris</u>	67.11 $\pm$ 8.99 ^b	64.28 $\pm$ 3.54 ^a
	Sod. <u>citrate</u>	64.25 $\pm$ 7.99 ^b	41.17 $\pm$ 8.02 ^c

a, b, c = Means with different superscripts in the same column differ significantly ($P < 0.05$).

Table 2 : Digestibility coefficients (%) of diets fed to sheep

	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
Dry	71.35	66.10	69.48	69.18	67.58	67.68
matter	±1.76	±2.52	±2.94	±1.83	±2.55	±2.69
Organic	74.10	69.06	72.58	72.41	70.28	70.76
matter	±1.64	±2.39	±3'.70	±1.91	±2.21	±2.48
Crude	66.53	65.39	63.60	52.42	64.69	61.21
protein	±3.13a	±2.28a	±1.39a	±1.04b	±2.81a	±4.37a
Crude	78.23	68.18	74.36	68.36	67.78	71.33
fibre	±1.78c	±1.98de	±1.92ce	±2.1 1 de	±2.21d	±2.46de

a , b = means in the same row with different letters differ significantly at **P** < .01. LSD (.01) = 10.2 LSD (.05) = 7.27

c , d , e = means in the same row with different letters differ significantly at **P** < 0.01. LSD (.01) = 9.01 LSD (.05) = 6.44

Table 3: Performance of Sudan desert sheep in control and experimental diets

	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
Initial weight (Kg)	35.1	35.1	34.1	35.1	35.0	35.1
Final weight (Kg)	32.5	42.35	35.55	40.50	42.45	42.20
Experimental period (days)	75	75	75	75	75	75

Average daily gain (g)	-2.55	96.67	19.33	72.00	99.33	94.67
Total daily intake (g)	878	1228	1153	1184	1204	1205
	±83.6a	±10.6b	±6.8b	±16.1b	±14b	±25.1b
Daily hay intake (g)	878	728	653	684	704	705
	±83.6c	±10.6d	±6.8d	±16.1d	±14.0d	±25.1d
Intake / W⁷⁵	64.84	73.30	79.29	75.00	72.60	72.94
Feed efficiency (feed/gain)		12.70	59.70	16.60	12.12	12.72

a , b = means in the same row with different letters differ significantly at $P < 0.01$. LSD

(.01) = 146 LSD (.05) = 108.

c , d = means in the same row with different letters differ significantly at $P < 0.01$. LSD

(.01) = 146 LSD (.05) = 108.

The cost of supplementing native hay is given in Table 4 for 1984 market prices. It was evident that cottonseed cake was the most expensive supplement. When sorghum bran or both sorghum bran and groundnut haulm were added to cottonseed cake the cost of supplementation notably decreased.

Table 5 shows the economic evaluation of the gain based on the year of the study 1989 farm gate meat prices. It was clear that economic efficiency increased substantially when either sorghum bran or sorghum bran plus groundnut haulm were added to cottonseed cake. Gross profit results also confirmed this point.

Native hay used in this experiment was composed of four speices which were not necessarily representing the most nutritive speices in Kordofan region, but were available at the time of the experiment. They represent the available feed for grazing animals during the dry season. Their nutritive contents, particularly protein can not maintain animals and actually the CP intake per day of the animals fed on native grass hay was only 53 g which according to NRC (1985) is far below maintenance requirements of the experimental animals. Therefore, supplementation of native grass hay at the village level seems to be a necessity for maintaining a satisfactory level of animal productivity.

The depression of digestibility of nutrients obtained in this study was in line with the results obtained by Ndlova and Buchanan Smith (1987), but contradicted the results reported by Mosi

and Butterworth (1985). The depression found in this investigation can be explained by the increasing intake concomitant with supplementation (Van Soest, 1983). The high digestibilities, especially for fibre content, obtained with native hay when fed alone, may probably be due to the fact that the cell wall of these particular grass species contains high amount of cellulose and hemicellulose which are known to be more digestible in the rumen and stimulate fibre digestion (Silva and Orskov, 1985).

Table 4: Cost of feed throughout the experimental period calculated according to 1989 market prices (LS).

	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
Native hay	29.63	24.56	22.04	23.46	23.77	23.77
Cottonseed cake	—	155.62			77.81	51.86
Groundnut haulm	—		9.37			3.12
Sorghum bran	—		—	101.25	50.62	33.74
Total	29.63	180.18	31.41	124.71	152.20	122.49

Table 5 : Economic evaluation of gain from feeds used.

	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
Daily gain (g)	-.034	.087	.019	.072	.099	.095
Value of daily gain (LS)*		.97	.19	.72	.99	.95
Feed cost per day per animal	.07	.48	.08	.33	.40	.29
Economic efficiency	—	2.02	2.37	2.18	2.47	3.27
Gross profit per day per animal (LS)	—	.49	.11	.39	.59	.66
Feed cost per Kg liveweight gain (LS)		4.94	4.21	4.58	4.02	3.05

* Calculated on the basis that the farm gate price of meat in 1989, time of **the study**, was LS 20/Kg.

All supplements increased significantly ($p < 0.05$) total dry matter intake when added to native hay, while the intake of native hay itself was clearly depressed. This is in agreement with the work of Mosi and Butterworth (1985): Other workers reported an increase of basal diet intake due to supplementation (McMenium et al. 1988; Preston and Leng 1987). However, the depression in the basal diet intake reported here, may be attributed to the substitution effects as the amount of supplement offered to the animals in this study was 0.5 kg which constituted more than 40% of the total intake. This is in line with Johnson and Oliver (1988) who suggested 0.3 kg as a maximum supplement to small ruminants. Also, the depression of basal diet intake in this study may be explained by the CP level. In a previous study Mosi and Butterworth (1985) associated the depression of the basal diet intake with the dietary CP levels of less than 8%. Minson and Milford (1967) reported a similar explanation of the basal diet due to supplementation.

With the exception of groundnut haulm, all other supplements notably improved feed efficiency and weight gain. Groundnut haulm only maintained the animals and allowed for little gain. It is noteworthy that the results obtained with sorghum bran were comparable to those obtained with cottonseed cake. However, the most interesting finding from this study was the results achieved when sorghum bran substituted 50% of cottonseed cake and when the three supplements were combined together as one supplement. It is clear that the performance of animals on cottonseed cake plus sorghum bran on the three supplements together was similar or better than when cottonseed cake was offered alone. The practical implication of these results is that the cost of supplementing animals during the dry season can effectively be reduced if locally available feed resources within the small farm unit and the by-products of the expanding milling industry are used instead of or together with to expensive oilseed cakes. The economic analysis of this study (Tables 4 and 5) confirmed this finding and showed that 16% of the cost of supplementing native hay with oilseed cake can be reduced if only 50% of the cake was substituted by sorghum bran. However, this figure increased to 40% if two thirds of the cake, as in treatment (6), were substituted by both groundnut haulm and sorghum bran. In addition, the economic efficiency and the gross profit appreciably increased making supplementetation by sorghum bran and groundnut haulm economically attractive.

It is concluded that groundnut haulm can be used to supplement animals during the critical period of the dry season to avoid weight losses and maintain non-producing animals. The combination of

groundnut haulm and sorghum bran with oilseed cakes can be used to reduce the cost of sustaining high levels of animal productivity and flushing animals before the onset of the breeding season in July. However, further research is needed to evaluate other legume hays available in the region especially cowpea.

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Authors:

Dr. Omer Ibrahim Kurdi. Eltigani Mohamed El-Amin.