Effects of Feeding Milled Sorghum Stover in a Conventional Concentrate Diet on Performance of Western Sudan Baggara Cattle.

A.F. Mustafa, T.A. Mohammed and A.E. El-Tayeb

Institute of Animal Production, University of Khartoum, P.O. Box 32, Khartoum North, Sudan.

SUMMARY

Twenty four mature Western Sudan Baggara bulls (364.5± 4.7 SE) were divided into four similar groups of six animals each and employed in a feeding trial that lasted for eight weeks. The groups were allotted at **random to one of four diets contained 0, 25, 35 or 45% milled sorghum stover (MSS) incorporated in a conventional concentrate diet (CCD) based on sorghum grain and cottonseed cake. All diets contained 1%** NaCl. **The average daily dry matter intakes, liveweight gains (kg) and feed conversion ratios for the four groups were 10.4, 1.4, 7.4; 11.0, 1.5, 8.0; 10.7, 1.4, 7.6 and 11.8, 1.4, 7.9, respectively. All performance parameters were not affected (p>0.05) by dietary treatments.**

Digestion coefficient of dry matter (DM), organic matter (OM) and crude protein (CP) as determined by sheep were significantly lower (P<0.05) for diets contained MSS than for the zero MSS diet. Digestion coefficient of acid detergent fibre (ADF) was not affected (P>0.05) by treatments. The estimated DM, OM, CP digestion coefficient and total digestible nutrients percentage kTDN%) of MSS alone were 47.2, 43.6, 28.3 and 49.1%, respectively.

INTRODUCTION

Finishing beef cattle in the Sudan is heavily depending **on feeding** concentrate diets. The diet of choice to feedlot operators **consists of** equal parts of sorghum grain and cotton seed cake. The simplicity **of** formulation and availability of ingredients are among the **reasons** behind the popularity of this feeding regime. However, recent increased demands of sorghum grain and cotton-seed cake elevated prices to levels that limited the expansion of feed lot operations in this country. Therefore the attention of ruminant nutritionists has been devoted to crop r.,sidues and agro-industrial by-products as means of decreasing the cost of finishing beef cattle. In the Sudan the estimated annual yield of crop residues of which sorghum stover is the major one is about 5.5 million tons of dry matter (El Hag and Kurdi, **1986).**

Beef cattle performance **on** sorghum stover could **be improved by** chemical treatments and supplementation (El Hag and Kurdi, **1986 and** Herrera and Balderas, 1987). Mohammed Salih (1986) and El **Hag and** Goerge (1981) have shown the feasibility of incorporating **MSS in** a concentrate beef finishing diet up to 30%. Hence the objective of this study was to investigate the effects of partial replacement of **the CCD with high proportions of MSS on performance of Western Sudan** Baggara Cattle and to assess the nutritive value of MSS.

MATERIALS AND METHODS

Feeding trial

Twenty four mature feeder bulls of Western **Baggara type were** stratified according to liveweight into four groups of six **animals each.-**

Then these groups were randomly allotted to one of the dietary treatments described in Table 1. Bulls in each group were subdivided into **two subgroups of three animals each and fed their respective diets** (3 **animals/pen) with water being freely available through out the experimental period. The diets were introduced through a 7 day adaption period followed by a 56 day experimental period during which the diets were offered *ad lib.* Daily feed intakes (kg) were recorded and the experimental animals were weekly weighed following** ar, **over night** fast.

Table: 1 Ingredients and chemical composition of the experimental diets.

Variable	Diet	treatments		
Ingredients (% as fed basis)				
Milled stover	0.0	25.0	35.0	45.0
Sorghum grain	49.5	37.0	32.0	27.0
Cottonseed cake	49.0	37.0	32.0	27.0
NaC1	1.0	1.0	1.0	1.0
Chemical composition (% dry matter)				
Organic matter	91.2	88.4	88.1	88.3
Crude potein	22.8	18.2	16.8	15.4
ADF	25.0	28.4	32.5	34.1
Ligniii	6.2	6.5	7.1	7.0
GF (Mcal/Kg)	4.6	4.4	4.3	3.9 .

Digestibility trial

A digestibility trial was conducted to evaluate nutrients digestion of the experimental diets. Sixteen mature Sudan desert rams were involved in this trial. They were allowed a 5-day adaptation period during which the experimental diets were gradually introduced, followed by another 5-day adjustment period during which the *ad libitum* intakes were determined. Thereafter faeces were collected daily for a total collection period of 5 days. Chemical composition of diets and faecal samples were determined by standard method (A.O.A.C., 1980), acid detergent fibre (ADF) was determined by the procedure of Goering and Van Soest (1970). Gross Energy (GE) for both diets and faeces was determined using plain oxygen calorimeter (Parr Instrument Co. Moline, IL. 61265, U.S.A.) Digestion coefficients and TDN were calculated as described by McDonald *et al.* (1982). The nutritive value of MSS alone was estimated using regression equations relating digestion coefficients of different nutrients to the level of MSS in the CCD.

Data from the feeding and digestibility trials were subjected to analysis of ***variance*** (ANOVA) and differences among treatment means were detected using Duncan's multiple range test (Steel and Torrie, 1980).

RESULTS

Feeding trial

The effects of dietary level of MSS on feed-lot performance of Western Sudan cattle are shown in Table 2. Inclusion of MSS with the CCD up to 45% (W/W) had no effect ($P>0.05$) on intake parameters, final body weight, liveweight gain and feed conversion ratio.

Table: 2 Effect of dietary level of milled sorghum stover on feedlot performance of western Sudan cattle.

Variable Ingredients (% fed basis) Variable	Diet treatments Level of milled sorghum stover (%) 0	25	35	45	SE
Initial body weight (kg)	364.0	364.00	364.4	365.2	4.70 NS
Final body weight (Kg)	433.0	442.3	442.60	445.00	6.20 NS
Daily (kg)	1.4	1.3	1.4	1.4	0.40 NS
Daily matter intake (kg)	10.4	11.0	10.7	11.8	0.40 NS
Daily dry matter intake (g/kg 0.75)	124.8	131.7	128.3	141.3	3.75 NS
Daily dry matter intake (% body weight)*	2.9	3.0	2.9	3.2	0.04 NS
Feed conversion ratio (kg feed/kg gain)	7.40	8.5	7.60	8.4	0.12 NS
Cost of feed (Ls/ Kg gain)	5.3	4.8	4.10		

* Calculated in relation to initial body weight.

Digestibility trial

The results of the digestibility trial are shown in Table 3. Inclusion of MSS significantly ($P<0.05$) decreased DM, OM, CP and energy digestion coefficient without effect on ADF digestion coefficient. Significant ($P<0.05$) reduction in TDN% was observed when the level of MSS was increased from 0 to 25% of the diet.

Table 3 Effects of dietary level of milled sorghum stover on nutrients digestion coefficients and TDN percentage.

Variable	Level of milled sorghum stover (%) 0	25	35	45	SE
Dry matter	64.4^{a}	58.9^{b}	57.5^{b}	57.0^{b}	1.01 *
Organic matter	68.2^{a}	62.4^{b}	58.5^{c}	57.7^{c}	0.83 *
Crude protein	66.4^{a}	56.7^{b}	53.6^{bc}	49.1^{c}	1.50 *
ADF	35.6	33.6	33.9	36.3	1.20 NS
Energy	70.3^{a}	61.9^{b}	55.5^{0}	57.3^{0}	0.90 *
TDN (%)	71.6^{a}	58.9^{b}	57.3^{b}	60.9^{b}	0.56 *

Means in the same row with different superscripts are significantly ($P<0.05$) different.

Estimated nutrients digestion coefficients, and TDN% of MSS alone are given in Table 4. Digestion coefficients of DM, OM, CP and TDN% were estimated to he 47.2, 43,6, 28.3 and 49.1% respectively.

The partition of TDN consumed by the experimental groups is shown in Table 5. The amount of TDN required for maintenance was calculated using the initial body weight according to NRC (1976). The ratio of conversion of TDN above maintenance (cofficiency of TDN utilization) into weight gain was calculated by dividing the amount of TDN consumed above maintenance requirements by the average weight gains. The efficiency of TDN utilization for gain was 3.2, 2.6, 2.1 and 2.7 for 0, 25, 35 and 45% MSS groups, respectively.

Table 4. The estimated nutrients digestion coefficients and nutritive value of milled sorghum stover.

Variable:	Digestion coefficient (%)
Dry matter	47.2
Organic matter	43.6
Crude protein	28.3
Energy	32.2
TDN (%)	49.1

Table 5. Partition of consumed TDN into maintenance and production compared to values recommended by NRC (1976).

Variable	Level of milled sorghum stover			
	0	25	35	45
Amount of TDN consumed (kg/day)	7.4	6.5	6.1	7.2
Amount of TDN required for maintenance(kg/day)	3.0	3.1	3.1	3.1
Amount of 'MN utilized for daily gain (kg)	4.4	3.4	3	4.1
Amount of TDN required to produce similar gain (kg)	4.1	4.1	4.1	4.1
Efficiency of TDN utilization (kg above maintenance kg/gain)	3.2	2.6	21.	2.7

DISCUSSION

In this study sorghum stover was incorported with the CCD up to 45% (W/W) without negative effects on performance parameters. This is in agreement with the reports of Swan and Lamming (1970) and Lamming *a oL* (1966) who used milled barley starw as a substitute **for** maize. In contrast to our results, significant reduction in daily liveweight gain of beef cattle was reported by Gebrewolde t *aL* **(1978)** as the level of corn stover in the finishing diet was increased from 30 **to** 50%.

The effects of inclusion of MSS with the CCD were **more** pronounced with nutrients digestion than with feedlot performance. **The** results obtained in the digestibility trail are in accord with the results reported by Lamming *ft oL* (1966), Levy *a oL* (1972) and Smith (1980). The reduced CP consumption observed with diets containing increased levels of MSS contributed to the observed depressed **CP** digestion coefficient because of the higher proportional **effect of** metabolic faecal nitrogen. This portion of nitrogen is a **constant tax** regardless of the level of dietary protein intake.

The estimated nutrients digestion coefficients **of MSS indicated** its low nutritive value. The estimated TDN% was 49.1%. This **value was** higher than the value reported by Nour (1986) for rice straw **and was** lower than the value reported by Osman (1985) for sorghum **stover.** The value of OM digestion coefficient was similar to that of **barley** straw as reported by Andrews *a oL* (1972).

The animals fed on diets contained MSS consumed less **TDN`** (Kg/day) while those on the CCD consumed more TDN than what is

recommended by NRC (1976) to produce similar weight gains. These results showed clearly that in local type animals a considerable amount of energy (about 1 kg TDN for each kg gain) could be wasted by feeding the CCD to finishing Sudan Baggara cattle. In this respect Mohammed Salih (1986) indicated that Sudan Baggara cattle are highly efficient in converting energy in the agro-industrial by-products into beef.

It was concluded that traditional system of free choice concentrate feeding is wasteful. MSS could be employed satisfactorily as cheap energy with the GCD up to 45% (w/w) without negative effects on performance parameters. Under the prevailing conditions of the Sudan, milling of sorghum stover is in-convenient to some feedlot operators and definitely increases the cost of production. Nevertheless, it is thought that the feasibility of using high levels of MSS as a substitute for the CCD would be more tempting to more feedlot operators to adopt t.

REFERENCES

Andrews, R.P., Escnder-Vobonte, J.C. and Hoilmes, W. (1972). The influence of supplements of energy and protein on the intake and performance of cattle-fed on cereal straw. *Anim. Prod.*, 15 : 167 - 176.

A.O.A.C. (1980). *Official methods of analysis* (13th ed.). Association of Official Analytical Chemists, Washington, D.C.

El Hag, G.A. and Goerge, A.E. (1981). Performance of western baggara **bulls fed on rations containing high levels of poor quality agro-industrial by-products.** *E. Afr. Agric. for. J.,* **47:43-48.**

El Hag, M.G. and Kurdi, O.I. (1986). Prospects for efficient utilization of agro-industrial by-products and crop residues for ruminant feeding in the Sudan with emphasis on quantification, nutritional composition, constraints and research results. ARNAB. *Towards optimal feeding of agricultural by-products to livestock in Africa: Proceeding of a workshop held at the university of Alexandria, Egypt,* October, 1985. ILCA. Addis Ababa, Ethiopia.

Gebrewolde, A., O'Donovan, P.B., Gebremariam, H., Kebede, B. Galal, E.S.E. (1978). Fattening studies with cross bred (European X Zebu) bulls. 2-Rate and efficiency of gain on diets of maize residues and concentrate. *JAgric. Sci. Camb.*, 90: 431-434.

Goering, H.K. and Van Soest, P.J. (1970). *Forage analysis*. Agricultural Handbook No. 379. Washington, D.C. Agrie. Res. Service, United States Department of Agriculture.

Herrera, S.R. and Balderas, L. (1987). Utilization of corn and sorghum stovers treated with an hydrous ammonia in rations for feedlot bulls. *J. Anim. Sci.* 65: *Supp.* (1): 449-500 (abstr.)

Lamming, G.E., Swan, H. and Clarke, R.T. (1966). Studies on the nutrition of ruminants. 1-Substitution of maize by milled barley straw in a beef fattening diet and its effect on performance and carcass quality. *Anim. Prod.* 8:303-311.

Levy, D., Amir, S. Holzer, Z. and Newmark, H. (1972). Ground and pelleted straw and hay for fattening Israeli-Friesian male calves. *Anim. Prod.* 15: 157-165.

McDonald, P., Edwards, R.A. and Greenhalgh, J.F.D. (1982). Animal Nutrition. Longman, London and New York.

Mohamed Salih, G.M. (1986). *Effects of sorghu.m straw feeding on feedlot performance of cattle.* M.V.Sc. Thesis. University of Khartoum PP. 88-89.

Nour, A. M. (1986). *Utilization of rice straw in small farms in Egypt, ARNAB. Towards optimal feeding of agricultural by-products to livestock.* Proceeding of a workshop held at the University of Alexandria, Egypt. October, 1985, ILCA. Addis-Ababa, Ethiopia.

N.R.C. (1976). National Research Council. *Nutrients requirements of domestic animals. 4-Nutrients requirements for beef cattle.* National Academy of Science/National Research Council, Washington, D.C.

Osman, A.G. (1985). *Effect of nitrogen source and levet of nutrient utilization performance of Sudan desert lamb. M.V.Sc.*

Thesis. University of Khartoum PP. 89-90.

Smith, T. Broster, W.H. and Siviter, J.W. (1980). An assessment of barley straw and oat hulls as energy sources for yearling *cattle. J. Agric. Sci. Camb.* 95:677-686.

Steel, R.G. and Torrie, J.H. (1980). *Principles and Procedures of Statistics* (2nd ed.) McGraw Hill, New York, pp. 137-220.

Swan, H. and Lamming, G.E. (1970). Studies on the nutrition of ruminants. 5. The effect of diets containing up to 70% ground barley straw on the liveweight gain and carcass composition of yearling Friesian cattle. ***Anim. Prod.*** 12:63-70.