EFFECTS OF PARTIAL REPLACEMENT OF CONVEN- TIONAL CONCENTRATE DIET WITH COTTON GIN TRASH ON NUTRIENTS UTILIZATION AND FEEDLOT PERFORMANCE OF LAMBS

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SUMMARY

The effects of the partial replacement of a conventional concentrate diet with cotton gin trash (w/ w) were investigated using feeding and nitrogen balance-digestibility trials. A 10 week feeding trial was conducted using a randomized complete block design employing 16 Sudan Desert Lambs (mean wt. 28.4 Kg). Treatments were: 0%, 25%, 40% and 55% cotton gin trash added to a diet based on sorghum grains and cottonseed cake. The feeding trial results indicated that average daily dry matter intake (1.4 Kg) and mean body weight gain (167 g) were not affected by the treat- ments. However, the latter parameter tended to be lower (138 gl day) when lambs were offered the diet inpwhich 55% (w/ w) was replaced with cotton gin trash. The same lamb groups and experimental design employed in the feeding trial were used later in the nitrogen balance- digestibility trial. During this trial lambs were offered the experimental diets ad-lib. for 10 days of adjustment followed by 5 days of total urine and faeces collection. Apparent digestibilities of organic matter, and ether extract were not affected ($P > 0.05$) by the treatment but the apparent di- gestibilities of crude protein, dry matter (DM) and energy were lower ($P < 0.05$) and those of nitrogen were higher ($P < 0.05$) for diets containing increased levels of cotton gin trash. Nitrogen retention was higher ($P < 0.05$) for diets containing CGT. However values tended to be higher for the 25% and 40% cotton gin trash containing diets. The results are interpreted to indicate that cotton gin trash can be used to replace up to 40% (wl

w) of sorghum grains and cottonseed cakes based diets without adverse effects on feedlot performance of lambs.

INTRODUCTION

Livestock production costs are often high in many parts of the world because of the shortage and high costs of conventional concentrate feeds. Many producers have considered the incorporation of the under utilized agro-industrial by products, such as cotton gin trash (CGT), in livestock diets as a costreducing alternative. ' Current agricultural statistics of the ministry of Agriculture, Sudan (1984) indicate that for every ton of seed-cotton processed 0.3 ton of CGT is produced. It also indicates that the annual production of CGT produced in the Sudan amounts to about 70,000 metric tons. The bulk of this material is wasted and as such represents a fire and an environmental hazard. A literature search indicated that research relevant to the feeding yalue of CGT is scarce. The few experiments reported were conducted to investigate the effects of CGT as a replacer of concentrate or roughage in beef finishing and milking dairy cattle rations. Erwin and Roubicek (1958) reported that CGT should not exceed 40% (w/ w) in beef finishing diets. Brown et al. (1979) suggested that CGT should not be fed at levels higher than 25% of the concentrate offered to milking dairy cows. Similar general guidlines for feeding CGT to sheep are lacking. The objective of this research was to determine nutrient digestion and feedlot performance of lambs fed conventional concentrate based diets containing graded levels of CGT.

MATERIALS AND METHODS

Sixteen 7 - 9 month old Sudan Desert Lambs weighing 28.4 1- 0.2 Kg were treated for internal and ecto-parasites before they were placed in in- dividual feeding stalls. A randomized complete block design was em- ployed to determine dry matter intake (DMI) and average daily gain (ADG) of the lambs fed the experimental diets ad-lib. for a period of 10 weeks. The experimental diets were made by substituting 0, 25,

40 and 55% (wl W) of a conventional concentrate diet with ground CGT. The conventional concentrate diet was composed of 37.0% sorghum grain, 37.0% cottonseed cake, _25.0% milled sorghum stover and 1.0% (w/ w) common salt. The CGT used in this study was collected from a neigh- bouring saw ginning mill during the ginning season which extends for a period of 5 months (Dec. - May). The CGT was composed of 44.4% cot- ton seed hulls, 32.1% dehulled cotton seeds, 10.2% undehulled cotton seeds, 1.1% lint and 13.2% soil particles. Proximate composition of the material have shown that it contained (% DM) 72.9, 27.9, 10.3, 15.6. 24.9, 21.8 and 22.7 organic matter (OM), crude protein (CP), crude fibre (CF), ether extract (EE), acid deteragent fibre (ADF), lignin and ash re- spectively. The experimental diets were offered in a complete mash form once in the morning. Water was present continuously and was changed daily. Lambs were weighed weekly and orts were collected daily immedi- ately before feeding. , At the end of the l0 week feeding trial the 16 lambs were placed in metabloism cages and were fitted with harnesses and canvas bags for to- tal collection of faeces. During a 15 day period lamb within each group (4 lambs) were fed the diet they were receiving during the feeding trial. One hundred and five percent of the DMJ during the 10 days adjustment was offered during the subsequent 5 days of total collection of urine and faec- es. Orts were collected daily, stored at - 20 degree C and composited for later anflysis. Faeces and urine collected daily and 10% aliquots were re- tained and stored at - 20 degree C. Urine was collected in Winchester bottles containing few drops of I-§SQ.Tlle 5 days samples of orts, faeces and urine were composited for each of the lambs. Nutrient analysis of the diets, orts, faeces and urine was determined using the methods of the Association of Official Analytical Chemists (A. O. A. C., 1980). Lambs performance, digestibility and nitrogen (N) bal- ance data were analysed statistically by analysis of variance (Steel and Torrie, 1980). When significant F-values ($P < 0.05$) for treatment effects existed, means were compared by Duncan's Multiple Range Test.

RESULTS

The effects of the replacement of various proportions of the con,ventional concentrate diet with CGT on the proximate composition of the experimental diets and performance of lambs are reported in tables I and 2 respectively. Increased levels of CGT depressed organic matter (OM), crude fibre (CF) and increased crude protein (CP) and ether extract (EE) contents of the experimental diets. Increased proportions of CGT in the diets had no significant effects on DMI and ADG of lambs receiving those diets. . t . Nutrients digestibility data are presented in table 3. Apparent digestibility's of CF decreased ($P < 0.05$) as the level of CGT increased in the diet. Dry matter and energy digestibility coefficients were significantly lower ($p < 0.05$) for the diets containing 55% CGT than for other diets. However, the apparent digestibility's of OM and EE were similar among the treatments. » "

Table 1: Proximate analysis of experimental diets (% DM).

Item	Experimental diets (% CGT)			
	0	25	40	55
Dry matter	94.6	95.0	95.2	96.1
Organic matter	88.5	86.4	86.8	81.2
Crude protein	17.2	20.9	22.4	23.5
Crude fibre	15.9	9.2	11.7	10.0
Ether extract	4.5	8.4	9.1	12.1
Ash	6.1	10.4	10.0	15.6

Table 2: Effects of level of cotton gin trash on average daily dry matter.intake (DMI) and weight gain (ADG) of Sudan Desert Lambs.

Item	Level of CGT in diet (%)				
	0	25	40	55	SE
No. of observations	4	4	4	4	-
Days on feed	70	70	70	70	-
DMI (Kg/ day)	1.4	1.4	1.5	1.4	0.1
ADG (g/ day)	163	182	186	138	19
Feed conversion (Kg feed/ Kg gain)	8.5	7.6	8.0	11.5	1.1

SE : Standard error of means.

Calculating nutrients digestibilities of CGT by difference indicated digestibility coefficients (% mean i standard deviation) of 58.3 i 4.4, 64.7 i 3.3, 81.2 :4: 5.9, 98.0 i 1.2 and 56.5 i 3.3 for dry matter, organ- ic matter, crude protein, ether extract and energy respectively. Nitrogen (N) balance data are reported in table 4. Nitrogen intake and urinary N tended to increase with increased level of CGT in the diet and were higher ($P < 0.05$) for the diets containing 40% and 55% CGT respectively than for the CGT free diet. Apparent digestibility of N was sig- nificantly higher ($P < 0.05$) for all diets containing CGT. Nitrogen reten- tion tended to increase with increased level of CGT in the diets and was higher ($P < 0.05$) for the diet containing 40% CGT than for the CGT free diet.

Table 3: Effect of level of cotton ging trash (CGT) in diets fed to Sudan Desert Lambs on dry matter, organic matter, crude fibre and energy apparent digestibilities (% DM).

Item	Level of CGT in diet (% W/ W)				
	0	25	40	55	SE
No. of observations	4	4	4	4	-
Dry matter	67.1 a	68.7 a	68.8 a	59.5 b	2.1
Organic matter	69.1	70.7	71.2	64.6	1.8
Crude fibre	47.7 a	35.8 b	36.6 b	22.3 c	3.1
Ether extract	81.6	86.4	90.1	90.4	2.6
Energy	67.8 a	68.0 a	66.9 a	59.4 b	2.2

SE : Standard error of means.
a, b & c : Means on the same row with different superscripts are significantly different ($P < 0.05$).

Table 4: Effects of level of cotton gin trash on N intake, N retention and N apparent digestibility in diets fed to Sudan Desert Lambs.

Item	Level of CGT in diet (%)				
	0	25	40	55	SE
N intake (g/ day)	25.0 a	30.2 ab	37.1 b	33.0 ab	3.0
Faecal N (g/ day)	11.2	10.4	11.2	10.9	1.5
Urinary N (g/ day)	8.1 a	9.7 ab	11.7 ab	13.9 b	1.1
N retention (g/ day)	5.7 a	10.2 ab	14.2 b	8.3 ab	2.2
N digestibility (%)	55.5 a	66.8 b	69.9 b	66.8 b	2.4

SE : Standard error of means.
a & b : means on the same row with different superscripts are significantly different ($P < 0.05$).

DISCUSSION

The reduced OM and the increased N and EE contents observed when increased proportions of CGT are incorporated in the diets reflects the proximate composition of the CGT. The high ash and EE contents of CGT could be a result of soil particles contamination and the presence of hulled and undehulled cotton seeds respectively. In contrast to the results of Erwin and Roubicek (1958) and Brown et al (197 9) the inclusion of CGT in the diets increased the apparent digesti- bility of N by as much as 24% over that of the conventional concentrate diet. This could be attributed to the higher CP (N X 6.25) contents of the former diet (over 20%). The observed depression of CF, DM and energy digestibilities with increased levels of CGT in the diets supports the hypothesis that high fat contents of diets (5.0% or more) would reduce CF, DM and energy digestibilities of diets inadequate or low in CF contents (White et al, 1958; Grainger et al, 1961 and Moore et al. 1986). The DMI and AD_G reported in this study were similar to those ob- served by El Hag and Mulchtar (1978), and lower than those observed by Mohammed (1986) for Sudan Desert Lambs fed conventional concentrate diets. In this study the ADG tended to be higher for lambs fed diets con- taining CGT at levels lower than 55%. The observed depression of dry matter and energy digestibilities with the 55% CGT, the improved N retention and growth rate of lambs fed the 40% CGT containing diet are interpreted to mean that CGT could be used to replace as much as 40% (WI W) of a conventional concentrate lambs fattening diet without adverse effects on performance or nutrient utilizanon.

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