THE INFLUENCE OF SUPPLEMENTS OF COTTON SEED CAKE ON THE UTILIZATION OF SORGHUM GLUME BY THE GOAT.

A.A. ADELOYE AND *J.O. FASETAN,

Department of Animal Production, University of Ilorin, Ilorin

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ABSTRACT

The influence of supplements of cotton seed cake (CSC) on the voluntary intake and utilization of sorghum glume (SG) by the goat was studied in a 4 x 4 Latin Square digestibility trial. The study involved a total of 12 West African dwarf goats made up of 8 dry, non-pregnant does and 4 bucks aged between 14 and 20 months with av. live weight of 13.7kg. There were four diets in all, made up of 3 experimental diets in which cotton seed cake replaced, in each case, 25, 50 and 75% of the sorghum glume. The control diet was the unsupplemented sorghum glume. The goats were fed dry matter at 4% of body weight and water and mineral salt lick were provided *ad libitum*. The dry matter intake (DMI) increased ($P<0.05$) with CSC supplementation but the DMI value between 50 and 75% CSC levels were comparable ($P>0.05$). Weight gains in all treatments were positive being highest (63.34±12.7 g/d) with the 50% CSC supplementation of the sorghum glume and lowest (11.67±10.85 g/d) with the (control) unsupplemented sorghum glume. Increases in the oil seed cake supplementation of the sorghum glume resulted in increases ($P<0.05$) in nitrogen intake across the treatments. Increases in the feed digestibility, nitrogen retention, digested feed energy and organic matter were significant ($P<0.05$) up to 50% cotton seed supplementation of the sorghum glume. The performances of the goats on the 50% CSC and 75% CSC supplementation of sorghum glume are comparable ($P<0.05$) in respect of feed intake, nitrogen retention and nutrients digestibilities. A juidicious use of the protein concentrate for optimum feed intake and feed utilization makes the 50% CSC supplementation more desireable. A 50% cotton seed cake supplementation of the sorghum glume is recommended as suitable in the dry season feeding of the goat.

Key words: Goat, sorghum glume, crop residue, nitrogen supplementation.

INTRODUCTION

Goat rearing in Nigeria is largely a low input minor farm activity concentrated mainly in the rural areas (Smith *et al,* 1987). According to Sumberg and Cassaday (1985), 75% of the rural population keep small rumimants with an average herd size of 2.5 animals per household, the goat being more commonly kept than the sheep. However, the goat has a serious set back arising mainly from non-availability of feeds during the dry season of the year (Okeke and Orji, 1987). The forages when available are unable, in quality, to meet the nutrient needs of the animals (Onifade and Agishi, 1990). These forages would mainly be the browse plant species. Egbunike and Ikpi (1990) reported an annual existence of 52 million tonnes of crop residues in the cereal belt of Nigeria. The sorghum glume is part of these crop residues. It is the threshed panicle of sorghum. Incidentally the largest concentration of goats is found in the cereal belt where these residues are found.

The crop residue is a poor quality feed of low digestibility and also contains low nitrogen (N) which limits voluntary intake and nutritional value (Keftasa, 1988). So the use of any crop residue requires judicious N supplementation for improved nutritional value. The goat is considered superior to other ruminant species in its utilization of poor quality, high fibre forages (Howe *et al,* 1988 and Dominique *et al.* 1991). An exploitation of this potential through improved utilization of the sorghum glume could enhance the productivity of these animals. This study assesses the potential of sorghum glume in the

*Deceased.

intake and nutrient needs of the goat. The effect of N supplementation from cotton seed cake and optimum level of such supplementation would also be determined for sorghum glume as a possible dry season feed for the rumimant specie.

MATERIALS AND METHODS

Animals and Housing

Twelve animals comprising 4 bucks and 8 non-pregnant, non-lactating does were involved. The animals were 12 to 30 months old and weighed 7.5 to 13.5kg. They were housed individually in metabolic crates suitable for easy collection of faeces and urine and provision of feed and water.

Medical care.

The animals were dipped against ecto-parasites, dewormed of helminths and treated for pneumonia as a routine practice prior to the commencement of the experiments.

Diet

Sorghum glume which is the threshed sorghum panicle was obtained from the farms and the cotton seed cake purchased from an office of the National Livestock Product Unit. The two feed resources mixed to provide 4 diets, the cotton seed cake (CSC) being added to replace (%) 25, 50 and 75 of the sorghum glume. The control diet was an unsupplemented sorghum glume.

Management

The animals were allowed 15 days to adjust to the diets. This was followed by 5 days of collection. Daily feed allowance was at 4 percent of individual body weights. Water was provided *ad libitum*. Both feed and water were offered at about 8.00 hours daily. There was free access to mineral salt lick.

Measurements

Animal weights and feeds.

Individual animal weights were taken prior to confinement, at the commencement of the collection and at the end of the collection. The feed residues were weighed to estimate the previous day's feed taken by each animal.

Faeces and urine

Daily individual faecal collections were weighed and 10% sub-sampled were dried at 70oC to constant weight. These were bulked for chemical analyses. Urine, collected in 5ml of 5% (V/V) glacial acetic acid was measured and 10% aliquot was stored at 4°C in the deep freezer for chemical analyses.

Chemical analyses.

The feed and faecal samples were milled to pass through a 1mm screen and subjected to proximate analyses following the standard procedures (A.O.A.C., 1980). The urine sampled were analysed for the total nitrogen by the routine Kjeldahl method (A.O.A.C., 1980) and energy was estimated from the digested organic matter (NRC, 1984).

Statistics.

The data obtained were subjected to analysis of variance test (Cochran and Cox, 1957) and treatment means tested (Duncan 1955).

RESULTS

The proximate composition of the diets are presented in Table 1. Organic matter, crude protein, ether extract and nitrogen free extracts increased with increasing cotton seed cake supplementation of the sorghum glume. A summary of the liveweight changes, feed and nutrient utilization are presented in Table 2. The dry matter intake (DMI) increased ($P < 0.05$) with CSC supplementation but the DMI value between (%) 50 and 75 CSC levels were comparable ($P > 0.05$). The DMI (% of body weight) ranged from 1.82 to 4.03 across the treatments.

Animals in all treatments were in positive weight balances. The highest weight gain (g/d; 63.34 ± 12.1) was prompted by 50% CSC supplementation and the lowest (11.67 ± 10.8) was by the control diet. The N intake and N retention values increased ($P < 0.05$) with increaseing CSC supplementation of sorghum glume. The variations in crude protein digestibility value across the treatments were statistically insignificant ($P > 0.05$). However the percentage digestibilities of dry matter,

TABLE 1: COMPOSITION OF SORGHUM GLUME BASED DIETS AS INFLUENCED BY COTTON SEED CAKE SUPPLEMENTATION. (g/100g DM)

	DIETS			
Sorghum glume	100	75	50	25
Cotton seed cake	0	25	50	75
Feed component Dry matter %	91.0	90.38	89.75	89.13
On dry matter basis				
Organic matter	84.4	86.47	88.55	90.62
Crude protein	8.2	13.03	17.85	22.68
Crude fibre	47.62	38.74'	29.86	20.97
Ether extract	7.9	9.33	10.75	12.18
Ash	15.60	13.53	1.45	9.38
Nitrogen-free extracts	11.68	15.75	19.84	23.92

TABLE 2: WEIGHT CHANGES, FEED INTAKE AND UTILIZATION OF SOME NUTRIENTS BY THE GOATS KEPT ON SORGHUM GLUME SUPPLEMENTED WITH COTTON SEED CAKE.

	Sorghum glume (SG)	75%S. G. + 25% supplement	50%S.G. + 50% supplement	25%S.G + 75% supplement	SE
Initial live weight Kg	11.25±0.7	11.23±1.6	10.63±1.0	10.90±1.1	
Final liveweight kg	11.43±1.0	11.63±1.4	11.58±0.8	11.67±1.7	
Weigh gain (g/day)	11.67±10.8	26.67±12.5	63.34±12.1	51.11±16.4	
Feed Intake g $^{W}kg^{-0.75}$	33.43^{a}±5.8	61.14b±5.5	68.49^{bc}±5.2	72.74c±8.4	SD
%BW	1.82±0.5	3.34±0.7	3.79±0.5	4.03±1.0	SD
Protein (N x 6.25)					
intake (g/d)	17.21^{a}±6.8	49.45^{b}±7.1	73.65^{c}±6.7	98.9d±4.2	SD
Loss (g/d) from					
Urine	0.47±0.4	0.85±0.5	1.35±0.5	3.07±1.1	
Faeces	11.10±7.4	33.33±9.2	47.21±9.5	59.83±10.5	
retention (g/d)	5.64^{a}±6.0	15.27^{ab}±7.5	25.09^{bc}±5.6	36.0c±6.1	SD
Energy digestible, Mcal/$Wkg^{0.75}$	0.032^{a}	0.084^{b}	0.12^{c}	0.15^{c}	SD
Metabolizable Kcal l/$^{W}kg^{0.75}$/d	25.89^{a}	69.17^{b}	98.66^{c}	115.38^{c}	SD
Digestibility, %					
dry matter	26.04^{a}±7.6	38.27^{b}±7.9	44.78^{bc}±6.4	50.08^{c}±7.3	SD
Organic matter	21.81^{a}±7.4	33.15^{b}±6.9	42.86^{c}±6.3	47.04^{c}±7.8	SD
Crude protein	22.86±10.5	28.49±10.2	35.51±13.3	36.45±12.1	

SD; Values are significantly different ($P < 0.05$)

±; standard deviation

1kg Digestible organic matter = 3.78Kcal metabolizable energy (NRC. 1984 metabolizable energy = 0.82 Digestible energy (NRC, 1984)

organic matter and energy increased with increasing CSC supplementation of sorghum glume. The differences in all the values were statistically significant ($P<0.05$).

DISCUSSION

The observed proximate composition of the unsupplemented sorghum glume typifies the nature of an agricultural crop residue and compares well with other works (Nzekwe and Olomu, 1984; Alhassan *et al,* 1986 and Lakpini, 1990) on crop residue. The progressive inclusions of CSC caused the observed changes in the compositions of the sorghum glume based diets. The range of DMI (61.14 72.74g/$W_{kg0.75}$) of the experimental treatments compares well with the reported values of Kearl (1982) and Adu and Lakpini (1983a). The DMI value and its increase upon supplementation confirms the importance of N supplementation for improved feed intake from the crop residue (Kellaway and Leibholz, 1983; Alhassan, 1987 and Smith *et al,* 1990) occasioned (Yilala, 1990) by increased microbial action in rumen fermentation.

The observed uniformity ($P>0.05$) in protein digestibility and significant ($P<0.05$) increase in nitrogen retention values across the treatments further support the importance of supplementation. At 50% CSC supplementation of sorghum glume, the digestible crude protein of 4.12g/$W_{kg0.75}$ per day obtained in this study would suffice for maintenance and growth as this value exceeds similar estimates by Adegbola (1974) and Akinsoyinu (1985). The metabolizable energy values on the (%) 50 and 75 CSC supplementation of the crop residue are comparable ($P>0.05$) and agree with the ARC (1980) standard as well as Akinsoyinu (1985) estimate for maintenance.

In general, the findings of this study indicate increased feed intake (Egan, 1965; Kempton and Leng, 1976 and Yilala, 1987) positive responses in weight gain (Kempton and Leng, 1976) and increased nitrogen retention (Egar 1965) as the sorghum glume is supplemented with the protein concentrate. The performances of the goats on the 50% CSC and 75% CSC supplementations are comparable ($P>0.05$) with regard to the feed intake, N retention and the nutrient digestibilities. So a judicious use of the protein concentrate would make the 50% CSC supplementation more desirable. The cotton seed cake should be fed along with the sorghum glume in a 1:1 ratio (i.e. 50% of each). Sorghum glume that is so supplemented would be adequate as dry season feed for the goat.

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