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Effects of Levels of Ficus (*Ficus sycomorus*) Supplementation on Voluntary Feed Intake, Nutrient Digestibility and Nitrogen Balance in Yankasa Bucks Fed Urea Treated Maize Stover Basal Diet

Research Article

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ABSTRACT

The study was conducted to evaluate the effects of feeding varying levels of *Ficus sycomorus* leaf forages as protein supplements to a basal diet of urea treated maize stover. Four Yankasa goats averaging one year and weighing 11.7±1.8 kg were used to measure the feed intake, digestibility and nitrogen balance. The basal diet (urea treated maize stover) was supplemented with 0 (T1), 50 (T2), 100 (T3) or and 150 (T4) g of fresh *F. sycomorus* leaves. The intake of the basal diet was significantly (P<0.05) affected by supplementation with browse foliage. T3 had significantly P<0.05 higher maize stover intake. Significant (P<0.05) increase in total dry matter intake, was observed, with T4 being highest. Dry matter digestibility DMD was significantly (P<0.05) increased with supplementation. T3 and T4 were significantly higher and statistically similar (87.09 and 83.83), followed by T2 (75.82) and least T1 (71.82). Supplementation significantly (P<0.05) increased nitrogen retention, with an increase in the level of supplementation observed in this order 9.93, 15.46, 21.62, and 25.01 g/d for T1, T2, T3 and T4, respectively. Evaluation of Nitrogen retention as a percentage of intake followed a similar pattern. *F. sycomorus* has potential as a protein supplement and could be offered at 100g/day in growing goats fed urea treated low quality basal diets.

KEY WORDS Ficus, goat, maize stover, urea.

INTRODUCTION

In the tropics, cereal crop residues such as maize, sorghum, millet stover and rice straw are produced in large quantities and could be used as ruminant livestock feed (Ehoche, 2002). However, cereal straws and stovers are characterized by low crude protein, readily fermentable carbohydrate, due to high lignin and silica and also of essential minerals (Leng, 1990). These characteristics resulted in low intake and digestibility of cereal crop residues, which results in decreased animal performance.

Various methods have been employed in order to improve intake and digestibility of poor quality roughages through treatment (chemical, physical, and biological) of residues and supplementation to increase their fermentation in the rumen, so that more energy would be provided, and voluntary feed consumption can be enhanced (Jackson, 1977 and Sundstøl, 1981).

However, (Wambui *et al.* 2006) reported treatment in itself alone is not sufficient to meet the animal's maintenance and production requirements. Supplementation is thus necessary in addition to treatment for meaningful production to be achieved (Munthali *et al.* 1991).

Both trees and shrubs(legumes and non leguminous) which persist during the seasons of pasture scarcity, have been shown to contribute protein-rich forage, digestible energy and minerals when used either as supplements or as sole feed (Abdulrazak *et al.* 1997). Several browse trees and shrubs (both introduced and indigenous species) have been reported to be used as supplements. Improved animal performance has been reported with Calliandra and Sesbania as supplement to maize stover and teff straw respectively (Kaitho, 1997; Nherera *et al.* 1998). Wambui *et al.* (2006) observed that supplementation with browse foliage of Tithonia generally increased the total dry matter intake. This may be attributed to ability of the forage supplements to provide nitrogen and energy for the cellulolytic microbes upon degradation in the rumen.

Ficus species are a part of a pan-tropical genus of trees, shrubs and vines occupying a wide variety of ecological niches and most are evergreen. The leaves and fruits of *F. thonningii*, *F. capensis* and, to a lesser extent *F. glumosa*, are rated as highly palatable to domestic animals (Audru, 1980; Le Houérou and Corra, 1980). The Ficus species are one of such browse plants with promising potential for ruminant livestock supplementary feed.

The objectives of the study were to evaluate the effects of supplementation with *Ficus sycomorus* to urea treated maize stover basal diet on voluntary feed intake, nutrient digestibility and nitrogen balance.

MATERIALS AND METHODS

Location of study

The study was conducted at the Teaching and Research Farm of the Department of Animal Science, Ahmadu Bello University, Samaru-Zaria, located on altitude 11^0 11' N and longitude 07^0 38' E. It is situated at an altitude of 686m above sea level and lies within the Northern Guinea Savannah zone. The mean relative humidity is 21 and 72% during the harmatan and rainy season respectively (Akpa *et al.* 2002).

Experimental design and animals

Four Yankasa bucks with an average body weight of 13.4 kg were used to study the feed intake, total tract digestibility and N-retention of urea treated maize stover supplemented with four levels of *Ficus sycomorus* leaves. The experiment was designed as a 4 x 4 Latin square arrangement in a completely randomized design. Each period lasted 15 days, consisting of 10 days for adaptation and a further 5 days of data collection. The diets were urea treated maize stover (basal diet), basal diet plus 0 g/d *F. sycomorus* foliage (T1), basal diet plus 50 g/d *F. sycomorus* foliage (T2), basal diet plus 100 g/d *F. sycomorus* foliage (T3) and basal diet plus 150g/d *F. sycomorus* foliage (T4). Water and mineral salt were freely available for all animals. The animals were kept in individual digestibility cages ideal for the collection of urine and fecal samples, as described by (Osuji *et al.* 1993).

Feeding management

The leaves of *F. sycomorus* were harvested daily from trees in the Livestock Teaching and Research Farm. Fresh quantities of the leaves were offered in the morning at 8:00 AM and thereafter the urea treated maize stover was offered and urea treated maize stover was offered again at 4:00 PM.

Chemical analysis

Feed and fecal samples were dried in an oven at 105 ˚C for the determination of dry matter. Total N of feed, feces and urine was measured by the Kjeldahl procedure as outlined by the AOAC (2000). The ash content of feed and feces was determined by combustion in a furnace at 500 ˚C, following the procedure of AOAC (2000). Organic matter was assumed to be the result of subtracting the percentage of ash from 100. Tannin was determined by the method of Wheeler *et al.* (1994).

Statistical analysis

All data collected on feed intake, nutrient digestibilities and nitrogen balance were calculated and subjected to statistical analysis of variance (ANOVA) using (SAS, 2001) procedure. Treatment means were significantly different. The Duncan Multiple Range Test (Duncan, 1955) was used to compare the treatment means.

RESULTS AND DISCUSSION

Chemical composition

The chemical composition of both untreated and urea treated maize stover indicated that urea treatment increased the CP of the maize stover from 8.75% in the untreated to 14.38% after urea treatment as presented in Table 1.

Table 1 Chemical composition (Dry matter) bases of urea treated and untreated maize stover and *Ficus sycomorus* leaves

	UMS	TMS	FS
Organic matter	81.79	79.50	85.23
Crude protein	8.75	14.38	11.38
Crude fiber	18.84	18.46	16.26
Ash	15.73	15.84	12.35
Tannin mg/100g	-	-	1.48

UMS: untreated maize stover; TMS: treated maize stover; FS: *Ficus sycomorus.*

This is in line with the pioneer works of Saadullah *et al.* (1981) who reported that crude protein content of rice straw increased from 2.9 percent in untreated straw to 5.9 percent. Abdu (1998) with sorghum stover and Lufadeju (1989) with Gamba grass (*Androgan gayanus*) treated with urea and both reported an increase in crude protein content of the crop residues. The high crude fiber of the treated and untreated maize stover (18) observed in this study is in agreement with Abdu (1998), who observed similar increases in sorghum stover and attributed it to the high cell-wall constituents usually present in cereal crop residues.

The CP contents of *Ficus sycomorus* in this study (11.38%) are however lower than the 14.90% reported by (Njidda, 2010). The differences observed in this study concurred with Ibrahim *et al.* (1988) who reported that environmental differences influence the chemical composition and digestibility of forages grown in different areas and harvested at the same age of maturity. They attributed the variation in the CP to differences in soil and environmental factors. The *F. sycomorus* had high ash content (12.35%). This is similar to that found in *Morus alba* (Nguyen and Le Duc, 2003) and probably an indication of high concentrations of minerals as reported by Kwabiah *et al.* (2003). High crude fiber was recorded in the *F. sycomorus* (16%). This is in agreement with (Anbarasu *et al.* 2004), that browse leave all have a high CF value, as this is one of the characteristics of most browse leaves which could be attributed to the high cell-wall constituents usually present in leaf meal.

Voluntary feed intake

The result of voluntary feed intake (VFI) is presented in Table 2. The result showed that T3 had significantly (P<0.05) higher stover intake (170.85 g/d), while there was no difference in stover intakes between T1, T2 and T4 (149.58, 157.50 and 158.3 g/d respectively). The increase in stover intake may be as a result of the supplementation with the *Ficus sycomorus* at moderate levels, because the supplementation of ligno-cellulosic residues with variable amounts of concentrate modifies the intake and the animal performance, depending on several factors, such as the kind of forage (Lamb and Eadie, 1979; Bocquier *et al.* 1987).

There was a significant (P<0.05) increase in the total dry matter intake of T1, T2, T3 and T4 progressively with increase in the level of *F. sycomorus* (149.58, 207.50, 270.85 and 308.35g/d respectively). This could be as a result of the progressive increase in the level of *Ficus sycomorus* fed to the bucks (0, 50, 100, and 150 respectively), which is supported by previous work where Wambui *et al.* (2006) observed that supplementation with browse foliage of Tithonia generally increased the total dry matter intake.

Nutrient digestibility

Nutrient digestibilities are presented in Table 3 and 4. Dry matter digestibility (DMD) was significantly (P<0.05) different across treatments. T3 and T4 were significantly higher and statistically similar (87.09 and 83.83), followed by T2 (75.82) and least T1 (71.82). The digestibility of CP followed similar pattern. Organic matter digestibility (OMD) produced a significant (P<0.05) increase with an increase in the level of *F. sycomorus* offered. Similar results have been reported by Kusmartono (2002), who found that supplementing rice straw (crop residue) together with nitrogen sources such as urea in the form of soft-cake molasses-urea block (MUB) and/or Gliricidia leaves, increased feed intake of rice straw as well as improving its digestibility both in sheep and steers. The result of nutrient digestibility reported in this study are higher compared to the values when jackfruit wastes alone were used to supplement rice straw as reported earlier by Kusmartono (2002). These may be attributed to the urea treatment of the maize stover, in addition to the supplementation, as treatment alone has been found to increase digestibility of urea treated sorghum stover (Abdu, 1998).

Table 2 Dry matter intake of Yankasa bucks fed urea treated maize stover supplemented with varying level of *Ficus sycomorus* leaves

	Levels of *F. sycomorus*				
Parameters	T1 (0)	T2 (50)	T3 (100)	T4 (150)	SEM
F. sycomorus intake (g/d)	0	50	100	150	0
Stover intake (g/d)	149.58^c	157.50^b	170.85^a	158.35^b	6.04
Total feed intake (g/d)	149.58^d	207.50^c	270.85^b	308.35^a	6.04

The means within the same row with at least one common letter, do not have significant difference (P>0.01).

Table 3 Nutrient digestibilities in Yankasa bucks fed urea treated maize stover supplemented with varying levels of *Ficus sycomorus* leaves

	Levels of *F. sycomorus*				
	T1 (0)	T2 (50)	T3 (100)	T4 (150)	SEM
	Apparent digestibility (%)				
Dry matter	71.82^c	75.82^b	83.83^a	87.09^a	1.68
Organic matter	69.36^d	73.70^c	82.80^b	86.87^a	1.85
Nitrogen	83.64^c	85.76^b	89.36^a	89.33^a	0.75
Crude fiber	31.68^b	40.21^a	42.24^a	41.51^a	2.91

The means within the same row with at least one common letter, do not have significant difference (P>0.01).

Table 4 Nitrogen balance in Yankasa bucks fed urea treated maize stover supplemented with varying levels of *Ficus sycomorus* leaves

	Levels of *F. sycomorus*				
Parameters	T1 (0)	T2 (50)	T3 (100)	T4 (150)	SEM
N balance, g/d					
N intake (g)	21.50^d	28.33^c	35.94^a	30.84^b	0.86
Fecal N output (g)	7.34	7.50	8.95^a	9.26^a	1.08
Urinary N output (g)	4.23^c	5.37^a	5.06^b	5.87^a	0.29
Total N output (g)	11.58^c	12.87^b	14.33^a	14.82^a	0.98
Nitrogen retention	9.93^c	15.46^b	21.62^a	17.02^b	1.21
As % of intake	46.19^c	54.57^b	60.02^a	55.19^b	2.04

The means within the same row with at least one common letter, do not have significant difference (P>0.01).

Nitrogen balance

The nitrogen balance showed a significant (P<0.05) difference in total N intake across dietary treatments, as presented in Table 4. T3 had significantly (P<0.05) higher N intake (35.94 g/d), followed by T4, T2 and T1 (30.84, 28.33 and 21.50 g/d respectively) in control treatment consuming urea treated maize stover. The increase in N intake is a result of the increasing level of *F. sycomorus* offered, while the lower intake in T4 when compared with T3 may be as a result of increase in tannin intake associated with the increasedlevel of *F. sycomorus*.

The fecal N and urinary N output recorded a significant (P<0.05) increase in the level of *F. sycomorus* offered. T4 had high fecal N (9.26 g/d), while T1 control had lower fecal N (7.34 g/d). The increase in the fecal N output in T4 could be due to the tannin as similar results have been found in goats using Wattle tannin extract.

N retention is considered as the most common index of the protein nutrition status of ruminants. N retention was significantly (P<0.05) different. As level of *F. sycomorus* increased, N retention increased from 0 to 100 g and decreased at 150 g. This is in agreement with Barry *et al.* (1986) and Reed *et al.* (1990) as cited by Merkel *et al.* (1996), all of whom suggested that Nitrogen retention decreases with inclusion of tannins in the diet because of the tannin-protein complex formed.

CONCLUSION

From the result of this study, it can be concluded that *F. sycomorus* has potential as a protein supplement offered at 100 g/d in growing goats fed urea treated low quality basal diets, to improve intake, nutrient digestibility and nitrogen balance.

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