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EVALUATION OF FICUS LEAF MEAL AS A REPLACEMENT FORCOTTON SEED CAKE IN THE DIET OF GROWING BUNAJI BULLS

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ABSTRACT

Sixteen growing Bunaji bulls between the ages of 12 to 15 months weighing 150 kg were used to study the effect of replacement of cotton seed cake with *Ficus thoningii* leaf meal, The animals were randomly allocated to four groups of four animals per treatment, each group were assigned randomly to one of the four dietary treatments consisting of inclusion levels of *Ficus thoningii* leaf meal which were included in the supplementary concentrate diet to replace cotton seed cake at 0, 10, 20 and 30 % inclusion levels in a completely randomized design. The result show that, Total feed intake (TFI) was 4.77, 4.79, 4.65 and 4.67 kg for 0, 10, 20 and 30 % of *Ficus thoningii* leaf meal (FTLM) inclusion levels, respectively. Average daily weight gains (ADWG) were 0.21, 0.29, 0.17 and 0.16 kg at 0, 10, 20 and 30 % inclusion levels of FTLM. ADWG was higher significantly ($P<0.05$) with 10 % inclusion level of FTLM and least at 30 % FTLM inclusion level. Nitrogen retention was significantly ($P<0.05$) higher at 10 and 20 % levels of inclusion of FTLM (12.49 and 12.76 kg/ day, respectively) compared to 11.30 kg for 30 % inclusion level. It is concluded that FTLM be included to replace cotton seed cake up to 20 % in diet of growing Bunaji bulls to prevent adverse effects on performance.

Keywords: Browse leaves, ruminant animals, intake and animal performance and nutrient digestibility

INTRODUCTION

The supply of adequate feeds in terms of quality and quantity for ruminant animal production becomes critical during the long dry season period (Adegbola, 2002). During the wet season of the year, forage plants including grasses, shrubs and browses from the natural rangelands are often in abundance (Alawa *et al.*, 2002) and offer wide choices to farmers keeping animals on intensive management, as well as the animal's reared on rangeland. The problem confronting subsistence ruminant livestock farmers in the tropical region is largely that of sustaining availability of adequate feeds into the dry season, as most grasses become matured and highly lignified. The feed resources available are mainly of cereal crop residues. Animals being fed on these seldom maintain their body weight and exhibit low reproductive performance.

Leaf meal from browse trees and shrubs when used as supplement offers a good source of easily digestible and extractable protein (Iyayi, 1991). Apart from the protein, they contain 2-8 per cent fatty acid, which plays an important role in ruminant nutrition. Leaves and fruits of some leguminous browse species have a much higher level of digestible crude protein (DCP) than other fodder sources. Guerin *et al.* (1986), reported 80 to 200g DCP /kg DM in browse compared to 100 to 130 for groundnut leaves and 50 to 70 for leaves and fruits of various herbaceous species.

Browse trees and/or shrubs form an integral part of tropical and sub-tropical farming system (Smith, 1993). In Nigeria, for example, the

pastoral calendar by Raay and de Leeuw (1974) shows that from February to March, ruminant livestock in the Northern part depend on browse plants for survival due to deterioration of grazing conditions. Also a study on traditional farming systems showed that farmers feed their animals with browse on cut- and- carry system during cropping season when animals are restricted Milligan and Sule (1982). Among the common browses species used are *Afzelia africana, Ficus* species, *Acacia* species, *Khaya senegalensis, Daniella oliveri* etc.

Ficus species belong to the family *Moraceae*. The characteristic of this family have been described by Keay *et al.* (1964), in which their main features include possession of latex, alternate leaves, paired stipules, minute flowers crowded in highly specialized inflorescences. According to Rendel (1979), the *Genus Ficus* contain 700 species spread through tropical and sub-tropical regions with 59 and 39 species in tropical West Africa and Nigeria, respectively Huchinson and Dalziel (1958).

Agishi (1985) attested to the high nutritive value of browse leaves to ruminant livestock. The proximate analysis of leaves of some *Ficus* species in the Northern Guinea Savannah of Nigeria ranged from 8.9 to 25.9 % (Bibi-Farouk, 1994; Jokthan *et al.,* 2003; Abdu *et al.*, 2012). The crude fibre level is low (7.7-36.8 %) compare to grasses. Total ash ranges from 3.7 to 31.3 % (Otaru,1998; Abdu *et al.*, 2012).

Many *Ficus* species are browsed by ruminants in different parts of Africa (Carew *et al.,* 1980; Le Houérou, 1980; Toutain, 1980) and Asia (Verma *et al.,* 1982) as fodder to alleviate feed crisis. Abdu *et al.* (2012) reported significant effect of *Ficus sycomorus* leaf meal supplementation on voluntary feed intake, nutrient digestibility and nitrogen balance in Yankasa bucks. Otaru (1998) also observed changes in the growth performance of red Sokoto bucks fed varying proportion of *F. thoningii* leaves, while Jokthan *et al.* (2003) reported the utilization of *F. thoningii* leaves by Rabbit.

Ficus species as multipurpose trees in the Northern Guinea Savanna Zone of Nigeria contain high level of crude protein. The plant is well integrated into the farming system. The high crude protein content and presence of green foliage during the critical period of the year makes it a good feed resource for the ruminants Bibi-Farouk *et al. (*2006).

Majority of the works reported on *Ficus* plants has been on Sheep (Lamidi *et al*1998; Bankole *et al.,* 2001; Yashim, 2014), goats (Otaru, 1998; Abdu *et al.,* 2012) and Rabbit (Jokthan *et al.,* 2003).These works have revealed the potentials of *Ficus* as dry season feed. However, there is little or no reported information on the use of *Ficus* for feeding cattle in the literature. Hence, the need to provide some basic information on the use of *Ficus* by cattle during the dry season.

The objectives of this study are to determine the effects of feeding *Ficus* leaf meal on dry matter intake digestibility in growing bulls.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Experimental Unit of the Beef Research Programme of the National Animal Production Research Institute (NAPRI), Shika, Zaria, Nigeria. The study area falls within latitudes 11^{o}N and 12^{o} N and longitudes7^{o}E and 8°E with an altitude of 640m above sea level (Encarta Encyclopaedia 2012). Shika is located within the Northern Guinea Savannah zone with an average annual rainfall of 1100mm which starts from early- May to mid-October. The maximum temperature range from 26 to 32^{o}C depending on the season, while the mean relative humidity during the hamattan and wet season are 21 and 72%, respectively (Ovimap, 2012)

Collection and Processing of *Ficus thoningii* Leaves

The leaves of *Ficus thoningii* was harvested in Shika and it's environ. The leaves were air-dried on a concrete floor in a well ventilated room and later stored in jute bags at room temperature until the commencement of the feeding trial.

Experimental Animals, Treatment and Design

Sixteen (16) growing Bunaji bulls between the ages of 12 to 15 months and with average body weight of 150 kg were randomly allotted in to four groups of four animals per group and each group was assigned randomly to one of the four dietary treatments. The dietary treatments consist of inclusion levels of *Ficus thoningii* leaf meals. This was included in the supplementary concentrate diet to replace Cotton Seed cake at 0, 10, 20, and 30 percent inclusion levels as presented in Table 1 in a completely randomized design.

Table 1: Composition of experimental concentrate diets

Ingredients	**Inclusion levels of *F. thoningii leaf meal***			
	0	**10**	**20**	**30**
Maize offal	76.53	67.37	58.23	48.93
Cotton seed cake	2.47	1.63	0.77	0.07
FTLM	0	10	20	30
Wheat bran	10	10	10	10
Rice bran	5	5	5	5
Poultry litter	5	5	5	5
Salt	1	1	1	1
Total	**100**	**100**	**100**	**100**
Calculated analysis				
Crude protein	15.25	16.63	15.13	15.00
ME(Kcal/kgDM)	2852	2737	2448	2474

FTLM=*Ficusthoningii leaf meal*

Management of Experimental animals

Prior to the commencement of the experiment, the experimental animals were treated against endo and ecto parasites using Acaricide and albendazole® according to the manufacturers recommendation. The animals were housed in individual pens. The experimental animals were fed the supplementary concentrate diets at 1.5 % of their body weight at 0900 h after the refusals of the previous day's feeding had been collected and weighed. During each feeding time, the animals were first given the concentrate ration and allowed 30-45 min to finish it before *Digitaria smutsii* hay was offered *ad libitum* as basal diet in troughs provided in the pens. Fresh clean water and mineral salt lick were provided *ad libitum*. The animals were weighed every two weeks. The growth trial lasted for 90 days.

Digestibility Trial

At the end of the growth trial, three bulls were randomly selected from each treatment group and housed in metabolism crates ideal for easy and separate total faecal and urine collection, as described by (Osuji *et al.,* 1993).

The animals were allowed 14 days of adjustment period to the conditions in the metabolic crates before the commencement of the collection period, which lasted for seven days. Known weights of the experimental diets were offered daily and water was provided *ad libitum*. Daily total faecal output was weighed and 10 % of each day collection was sub-sampled and oven dried at 60^{o}C for 48hrs for the determination of dry matter. This was later bulked, milled, sub- sampled and stored in plastic bottles, until required for laboratory analysis.

Daily total urine output was collected in plastic buckets containing 100 mls of 0.1N H_2SO_4 placed under the metabolic crate. A 10 % aliquot of the total daily urine output was taken from each bull, bulked and stored in the refrigerator pending analysis.

Antinutritional factors in Ficus leaves

Tannin was determined using the method described by Boham and Kocipai (1994) using tanic acid as standard, the coloured product developed was measured at 120nm within 10 minutes. Saponin was determined gravimetrically using the method described by Obadoni and Ochuko, (2001), alkaloid was determined by being precipitated using concentrated ammonium hydroxide as described by Harbone (1993). Phytate was determined by titration method as described by Wheeler and Ferrei (1971) using iron chloride as standard. cyanide (HNC) content were determined by the Knowels and Watkins distillation method as described by Pearson (1976).

Chemical Analysis

Fresh foliage of five *Ficus species (F. thoningii, F. sycomorus, F. polita, F. glumosa and F. platyphylla)*, experimental concentrate diets, *Digitaria smutsii* hay and faecal samples were analyzed for dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE), ash and nitrogen free extract (NFE), according to the Method of AOAC (2005). Acid detergent fibre (ADF) and neutral detergent fibre (NDF) were determined according to the Method described by Goering and Van Soest (1970). Hemicelluloses content were obtained by deference between NDF and ADF values (Church 1975). Urine samples were analyzed for nitrogen using the simple micro-Kjeldahl distillation method of AOAC (2005). The energy contents of the diets were calculated using the Method of Alderman (1985).

ME(MJ/kgDM)

$=11.78+0.00654CP+(0.000665EE)^2-CF(0.00414EE)-0.0118Ash.$

Statistical Analysis

Data collected on feed intake, weight gain, digestibility, rumen and blood metabolites, microbial counts were subjected to the Analysis of Variance (SAS 2001). The group treatment means that were significantly different were separated using Duncan's Multiple Range Test of SAS software. The following model was used.

$$\mathbf{Y_{ij} = \mu + T_i + e_{ij}}$$

where:

Y_{ij}=Any observation

μ = General mean,

T_i = Effect of i^{th} treatment (i = 0, 10, 20 and 30% inclusion levels),

e_{ij}= Random error

RESULTS AND DISCUSSION

Chemical composition of Experimental Diets

The chemical composition of *F. thoningii, Digitaria smutsii* hay and supplementary

concentrate diets are presented in Table 2. The CP level of *F. thoningii* in this study (13.69 %) is however, higher than the 12.55 % reported by Lamidi *et al.,* (2005) and similar 13.57 % reported by Otaru, (2006), but lower than the 14.90 % reported by Njidda, (2010). The differences observed in this study can be attributed to soil and environmental differences influencing the chemical composition and digestibility of forages grown in different areas and harvested at the same age of maturity (Ibrahim *et al.,* 1988). The Ash content of *F. thoningii* in this study (12.52 %) is similar to that reported by Lamidi *et al.* (2005) and Otaru (2006), This may be due to high concentration of mineral as reported by Kwabiah *et al.* (2003). High Crude Fiber was observed in the *F. thoningii* (20.79 %). This is in agreement with Anbarasu *et al.* (2004), who reported that browse leaves have a high CF. This is one of the characteristics of most browse leaves and this may be due to high cell–wall composition. The ADF content of *F. thoningii* (37.95%) was higher than that reported by Otaru (2006) but lower than that reported by Lamidi *et al.* (2005) and Njidda (2010). The variation in ADF content in this study may be due to the difference in the time of harvest and stage of maturity.

Table 2: Chemical composition of supplementary concentrate diets, *Digitaria smutsii* and *F. thoningii*

Parameters	***F. thoningii* inclusion levels**					
	0	**10**	**20**	**30**	***Digitaria smutsii***	***F. thoningii***
Dry matter	93.86	93.81	93.40	93.83	94.42	89.29
Crude protein	15.25	16.63	15.13	15.00	7.88	13.69
Crude fiber	21.78	19.71	22.43	19.64	35.69	20.79
Ether extract	9.60	4.42	8.43	6.74	3.61	16.11
Ash	6.62	5.61	7.15	6.74	4.56	12.52
NDF	41.72	43.63	45.75	46.66	68.43	38.05
ADF	16.69	22.64	25.58	28.28	47.32	37.95
Cellulose	19.04	18.88	18.34	22.91	38.96	39.00
Hemi cellulose	25.03	20.99	20.17	18.38	21.11	0.10
Lignin	3.13	3.90	7.70	6.12	5.50	26.20

ADF=Acid detergent fiber NDF=Neutral detergent fiber

The chemical composition of *Digitaria smutsii* offered as basal diet in this study was higher than those reported by Meissner and Paulsmeier (1995) but lower than those reported by Otaru (2011). The differences observed from the present study may be due to the stage of plant growth and/or season of harvest (Ben Salem, 2005) and site of sampling (Makkar and Becker, 1998).

The results of the levels of some antinutritional factors in the concentrate diets and *F. thoningii* are presented in Table 3. The level of phytate in *F. thoningii* was 0.21 % while HCN, saponin

and oxalate were 2.16 mg/ g, 5.80 % and 14.08 mg/ g respectively. Tannin levels increased from 0.23 to 0.34 mg/ g as the inclusion levels of *F. thoningii* increased in the concentrate diet.

The level of saponin increased from 2.17 in 0 % inclusion level of *F. thoningii* to 3.22, 3.60 and 3.98 % in supplementary concentrate diet with 10, 20 and 30 % levels of *Ficus* inclusion respectively. The levels of tannin and alkaloid in *F. thoningii* alone were 0.71 mg/g and 14.08 %, respectively.

Table 3: Levels of some anti nutritive factors in concentrate diets and *F. thoningii* leaf meal

Parameters	*F. thoningii leave meal* inclusion levels%				*F. thoningii*
	0	10	20	30	
Cyanide (mg/ g)	0.98	0.76	0.65	1.08	2.16
Phytate (%)	0.63	0.58	0.72	0.80	0.21
Oxalate (mg /g)	10.78	14.96	13.20	13.86	14.08
Alkaloid %	2.94	3.41	3.61	4.13	14.08
Saponin %	3.98	3.60	2.17	3.22	5.80
Tannin %	0.23	0.32	0.34	0.46	0.71

Performance of growing Bunaji bulls fed diet containing varied inclusion levels of *F. thoningii* leaf meal.

The result of feed intake and weight gain are presented in Table 4. The result showed that intake of basal diet and total feed intake were similar in animals fed diets containing 0 and 10 % inclusion levels of *F. thoningii* leaf meal (FTLM) and declined ($P < 0.05$) significantly as the levels of FTLM increased from 10 – 30 % across the treatments. Total feed intake at 20 and 30 % inclusion levels were however, similar. Brown and Puman (1991) however, stated that in some cases the use of legume supplement at between 10 – 20 % had resulted in an increased animal performance without significant increase in intake. The significantly lower intake observed in this study could be attributed to the increased level of some anti-nutritional factors that were present in the leaf meal, which increased as the level of inclusion increased in the experimental diets. These anti-nutritional factors have been reported to depress voluntary feed intake (D'mello, 1992; Meissner and Paulsmeier, 1995) as a result of their astringent reaction in the mouth, which reduces palatability (Bajec and Pickering, 2008).

The result showed that animals fed supplementary concentrate diet with 10 % level of FTLM inclusion had significantly ($P<0.05$) higher total body weight gain compared to bulls fed diets with 20 and 30 % inclusions, respectively. Also, animals fed diet containing 10 % inclusion level of FTLM had significantly ($P<0.05$) higher average daily weight gain (ADWG). The result obtained in this study is similar to the work reported by Jokthan (2003), who reported higher ADWG in rabbit fed *Ficus thoningii*. Several authors have reported similar results on different browse legume supplementations (Sultan, 2009;Njidda and Nasiru 2010).

Table 4: Influence of *Ficusthoningii leaf meal* supplement on feed intake and growth performance of Bunaji bulls

	Inclusion levels of *F. thoningii leaf meal %*				
Parameters	**0**	**10**	**20**	**30**	**SEM /LOS**
Initial wt gain/ kg	131.25	131.25	131.52	131.25	4.03^{NS}
Final wt gain/ kg	148.50	155.50	145.75	144.75	5.66^{NS}
Total wt gain/ kg	17.25^{b}	24.25^{a}	14.50^{b}	13.50^{b}	1.98*
ADWG/ kg	0.21^{b}	0.29^{a}	0.17^{c}	0.16^{c}	0.02*
Supplement intake/ kg	2.10	2.12	2.07	2.05	0.04^{NS}
Basal diet intake/ kg	2.66^{a}	2.68^{a}	2.58^{c}	2.62^{b}	0.03*
Total feed intake/ kg	4.77^{a}	4.79^{a}	4.65^{b}	4.67^{b}	0.06*
Intake as % BW /kg	27.62^{c}	19.72^{d}	32.07^{b}	34.59^{a}	0.002*
Feed/ kg gain	0.28^{c}	0.20^{d}	0.32^{b}	0.35^{a}	0.002*

[abc]Means with different superscripts within the rows differed significantly (P<0.05). wt=weight. ADWG=Average daily weight gain BW= body weight

Digestibility studies

Results of Nutrient digestibility of growing Bunaji bulls are presented in Table 5: The result showed that, animals fed diet containing 10 and 20 % inclusion levels of FTLM had significantly (P < 0.05) higher and similar DMD, followed by the animals fed 0% inclusion level of FTLM. The least DMD was observed in animals fed 30 % FTLM inclusion level. The result of OMD follow similar pattern. The CPD decreased significantly (P< 0.05) as the level of FTLM inclusion levels increased across the treatment, animals fed 0 and 10 % inclusion levels of FTLM had similar and higher CP digestibility which were significantly (P<0.05) higher than in animals fed 20 and 30 % inclusion levels of FTLM . The results of ADFD and NDFD follow similar pattern. The significant reduction in organic matter digestibility observed in the present study is in agreement with the report of Rotger *et al.* (2006) who stated that a change in feed ingredients alters the amount of OM and N and their fermentation rate in the rumen. With increasing inclusion of *Ficus*, the OM and CP decreased across the treatments. Pupo *et al.* (2002) had indicated that an increasing contribution of roughages in a ration could lead to a decline in cellulose digestion. The observed increased in NDFD and ADFD affirm the assertion that the escape of potentially degradable fibre substrate from the rumen, possibly resulted in a depression in NDF and ADF digestibility (Robble s*et al.*, 2007). However Pereira *et al.* (2007) found no effect of concentrate supplementation on apparent digestibility of nutrient.

Table 5: Nutrient digestibility in growing Bunaji bulls fed graded levels of *F. thoningii leaf meal*

Parameters	*F. thoningii* leaf meal inclusion levels %				SEM LOS
	0	10	20	30	
Dry matter D	56.66^{b}	58.96^{a}	58.20^{ab}	54.13^{c}	0.89*
OMD	61.23^{b}	63.63^{a}	62.52^{ab}	57.43^{c}	0.78*
Crude protein D	67.08^{a}	66.53^{a}	62.45^{b}	61.43^{b}	1.20*
ADFD	27.22^{a}	33.22^{a}	21.72^{b}	25.43^{b}	3.39*
NDFD	48.93^{a}	50.59^{a}	38.54^{ab}	40.29^{b}	1.19

a,b,c Different letters in each row differed significantly ($P < 0.05$) OMD =organic matter digestibility, ADFD=Acid detergent fiber digestibility NDFD=Neutral detergent fiber digestibility

Nitrogen Balance Studies

The results of Nitrogen balance studies in growing Bunaji bulls fed various levels of FTLM are presented in Table 6. Nitrogen intake decreased significantly (P< 0.05) at the highest inclusion level of FTLM. Animals fed 0, 10, and 20 % FTLM had similar result but lower value was observed in animals fed 30 % FTLM. This is in accordance with Pupo *et al.* (2002) who indicated that an increasing contribution of roughages in a ration could lead to a decline in cellulose digestibility. The result showed that as the levels of FTLM increased in the diet the urinary nitrogen increased, Urinary N in animals fed 0 % and 10 % inclusion levels of FTLM were similar and significantly lower (P < 0.05) compared to those fed 20 and 30 % inclusion levels of FTLM which were also similar. This agreed with the report of Otaru(2006) who observed that increase in levels of *Ficus* in the diet was associated with increase in urinary output.

Table 6: Nitrogen balance in growing Bunaji bulls fed varied inclusion levels of *F. thoningii leaf meal*

Parameters	*F. thoningii* leaf meal inclusion levels %				SEM LOS
	0	10	20	30	
Nitrogen intake (g/ day)	12.09^{a}	12.64^{a}	12.89^{a}	11.41^{b}	0.32*
Urinary N (g/ day)	4.86^{b}	5.25^{b}	6.81^{a}	7.44^{a}	0.44*
Fecal N (g/ day)	0.12^{bc}	0.14^{a}	0.13^{b}	0.12^{c}	0.01*
Total N excreted (g/ day)	4.98^{b}	5.39^{b}	6.95^{a}	7.56^{a}	0.44*
N balance (g/ day)	7.11^{a}	7.24^{a}	5.95^{b}	3.86^{c}	0.48*
N absorbed (g/ day)	11.96^{b}	12.49^{ab}	12.76^{a}	11.30^{c}	0.31*
N as % of intake (%)	41.07^{c}	42.72^{c}	53.96^{b}	66.58^{a}	3.69*

a,b,c Different letters in each row differed significantly ($P < 0.05$) N=Nitrogen

Fecal N excreted in animals fed FTLM at 10 % inclusion level was significantly higher (P< 0.05) and decreased significantly across the treatment showing lowest fecal N production in diet with 30 % inclusion level. The higher loss of nitrogen through feces in animals fed 10 % FTLM might be due to protein precipitating effect of tannins. Higher nitrogen excretion

through the faeces of animals fed tanniferous feeds was also reported by (Ritner and Reed, 1992) and Hove *et al.* (2001). This is not in agreement with the findings of Van Soest (1994). This author reported that when dietary content of tannin increased, faecal nitrogen excretion also increased due to low digestibility of nitrogen fractions and the formation of indigestible tannin protein complexes. Karda *et al.* (2001) reported differences in the faecal nitrogen of animals fed *Leucaena leucocephala*. Total nitrogen excreted was significantly ($P<0.05$) higher in animals fed 20 and 30 % FTLM as compared to those fed 0 and 10 FTLM. This might be due to tannin protein complexes formed from the dietary protein and voided undigested through faeces (Rittner and Reed, 1992; Hove *et al.*, 2001).

Animals were in positive nitrogen balance. The nitrogen voided through urine was higher than the nitrogen voided through feces. Higher loss of nitrogen through urine could be explained by the presence of dietary tannin and possibly periodic contents of the feed. Naslis and Malacheck (1981) and Barry *et al.* (1986) showed an apparent sparing of urinary nitrogen excretion but elevated faecal nitrogen excretion when ruminant were fed diets containing forages that are high in soluble phenolics/tannins.

Nitrogen retention was statistically ($P< 0.05$) highest in animals fed diets containing 10 and 20 % FTLM inclusion, while the least nitrogen retention was in 30% inclusion level of FTLM this is in agreement with Van Soest (1994) who reported that high level tannin may cause low apparent digestibility of nitrogen. A possible reason for good nitrogen retention recorded in this study, may be due to the relatively high fecal nitrogen at 10 % inclusion level of *Ficus* leaf meal. Nitrogen retention is the major indicator used to assess the protein nutrition status of ruminant livestock (Abdu *et al.,* 2012).

CONCLUSION AND RECOMMENDATION

It is concluded that:

- Total daily feed intake was highest (4.79 kg) in animals fed 10%FTLM and the least was 4.67 kg in animals fed 30 % FTLM inclusion levels.
- Bunaji bulls gained averagely on daily basis 0.21, 0.29, 0.17 and 0.16 kg at 0, 10, 20 and 30 % inclusion levels of FTLM.
- Nitrogen retention was significantly ($P<0.05$) higher at 10 and 20 % levels of inclusion of FTLM (12.49 and 12.76 kg/day respectively) compared to 11.30 kg for 30 % inclusion level.

It is recommended that smallholder farmers in Nigeria could include up to 10 % of FTLM in the diets of growing Bunaji bulls for improved performance. However, *Ficus thoningii* should be part of farmers agronomic practices because of its higher crude protein content and high biomass production.

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