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NUTRIENT DIGESTIBILITY OF RED SOKOTO BUCKS FED TWO FORMS OF BROWSE PLANT LEAVES IN SHIKA, NIGERIA

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ABSTRACT

A study was carried out to evaluate the nutrient digestibility of Red Sokoto bucks fed unwilted and wilted leaves of two browse plant species, namely: *Ficus thonningii* and *Gmelina arborea.* A total of twelve (12) Red Sokoto bucks of age 9-15 months weighing 21-24 kg were randomly allotted to four treatments with three bucks per group and fed the leaves of two browse plants leaves for 7 days in a 2 x 2 factorial arrangement in Completely Randomized Block Design. The nutrient digestibility of dry matter, crude protein, crude fiber, ether extract, nitrogen free extract ranged from 50 – 98.72% with highest value in *G. arborea* than *F. thonningii*.The acid detergent fiber and Neutral detergent fiber ranged from 62.27 – 73.27%. Nitrogen intake, fecal nitrogen, Urinary nitrogen, nitrogen absorbed and nitrogen retained were significantly (P<0.05) higher in *G. arborea* wilted, but negative values were recorded for unwilted *F. thonningii*. Wilting was found to positively influence (P<0.05) nutrient digestibility of all parameters in *Ficus thonningii*, but the reverse was the case with *Gmelina arborea*. Wilting was found not to influence (P>0.05) nitrogen intake in *Gmelina arborea* and *Ficus thonningii*, the same trend was observed with nitrogen absorbed. It is therefore concluded that the *G. arborea* was better digested and gave the best digestion of nutrients than the rest of the treatments.

Keywords: Nutrient Digestibility, Red Sokoto Goats, Two Forms of Browse Plants

INTRODUCTION

Livestock production transcends other sectors as key food and economic activity for many communities of Nigeria. Nevertheless, livestock production has been faced with major challenges of feed deficits, especially in the dry periods. One of the recommended practices to overcome challenges of feed deficits is the use of browse plants, especially during the dry season. Browse plants are available all year round because of their drought resistance, persistence, vigorous growth, re-growth and palatability (Crowder and Chheda, 1982). Browse plants are also found all year round in contrast to grasses which rapidly deteriorate with maturity increasing fiber and decreasing protein. Browse plants have higher nutritive value than grasses (Agishi, 1984). They provide vitamins and, frequently, mineral elements, which are mostly lacking in grassland pastures. Their year round evergreen presence and nutritional abundance provide for year round provision of fodder (Opara, 1996; Oji and Isilebo, 2000). It also enables standing feed reserves to be built so that herds can survive critical periods of shortfall, or even prolonged periods of dry spell without remarkable losses. Deforestation, urbanization and bush burning are

some of the major factors responsible for shortage of browse feed resources for ruminant livestock. Conservatory methods however, would ensure that locally adapted and well established species do not become extinct.

Gmelina arborea Roxb. is of the family*Verbenanceae*. It is a fast growing deciduous tree reaching up to 40 m in height and 140cm in diameter, but some could be smaller (Jensen, 1995). Previous records have shown that the leaves contained as much as 10.01-38.4% crude protein and 3.10-30.46% crude fiber (Adu*et al*., 1996; Ahamefule*et al*., 2006;Osakwe and Udeogu, 2007). *Gmelina arborea* has become one of the most widely planted species (second only to the *Eucalyptus* species) in the tropics. FAO (1989) recorded that by 1983, the Sahelian countries of West Africa had established about 5,850ha of *Gmelina arborea* in their anti-desertification plantation schemes.By 1990, Nigeria had established over 60,000 ha *Gmelina arborea* (Umeh, 1990).

Ficus thonningii is an evergreen tree of about 6-21 m, with a rounded to spreading dense crown.*Ficus thonningii,* also known as fig tree is a multipurpose tree that can be found almost everywhere in the northern part of Nigeria. Mecha and Adegbola (1980) identified fig tree as a palatable fodder plant with a wide distribution in the savannah zone of the humid tropics, while Agishi (1985) attested to the high nutritive value of its leaves to ruminant livestock.

MATERIALS AND METHOD

Experimental Site and Climate

The study was carried out in the Experimental Unit of the Small Ruminant Research Programme of the National Animal Production Research Institute (NAPRI), Shika, Zaria, Nigeria. Shika lies between latitudes 11 and 12 °N and between longitudes 7 and 33°E, at an altitude of 640 m above sea level. Shika is located about 20 km along the Zaria – Sokoto road in Northern Guinea Savannah zone of Nigeria. It has three distinct climatic seasons. The seasonal distribution of Shika's annual rainfall is approximately 617 to 1365 mm with a long time (50 years) average of 1041 mm. Most of the rains fall between May and June (Oni *et al.,* 1991). The mean maximum temperature and relative humidity range from 27-35^{0}C and 13.82%, respectively depending on the season of the year.

Source of Leaves of the Browse Plants and Animals

Leaves of the three browse plants were sourced around the National Animal Production Research Institute (NAPRI), Shika, Zaria . Every morning between 8-9 am, the leaves were collected from the *Ficus thonningii and Gmelina arborea*.The leaves were wilted for 24 hours before feeding to the animals the next morning. The unwilted leaves were provided to the animal directly from the tree and fed as unwilted every morning for the period of the trial.

Animal Management

A total of twelve (12) Red Sokoto bucks of age nine to fifteen months weighing twenty one to twenty four kg were obtained from the Small Ruminant Research Unit of the National Animal Production Research Institute (NAPRI), Shika. They were dewormed using Albendazolebolus and injected with Ivermectin to control ecto-parasite. They were also injected with oxytetracyclin so as to take care of all unwanted bacteria. The animals were housed in individual pens and weighed every fortnight. The pens were cleaned every day.Water was provided *ad libitum*.

Feeding Trial

12 Red Sokoto bucks were used for the experiment. The animals were fed a known weight of unwilted and wilted browse leaves *ad libitum* each for the period of seven days. The bucks were allotted to four dietary treatments in a 2×2 factorial arrangement in a completely randomized design, to compare the effect of unwilted and wilted forms of *Ficus thonningii*

tree leaves and *Gmelina arborea* tree leaves on the digestibility of red Sokoto bucks.

Digestibility Study

Three (3) bucks from each treatment group were housed in metabolic crates for total faecal and urine collection according to the procedure given by Osuji*et al.*(1993). The animals were allowed 14 days adjustment condition of the metabolic crates before the commencement of the collection period which lasted for another 7 days. The animals were fed experimental diets *adlibitum* daily. Daily faecal output was weighed and 10% of each day collection was sub sampled and oven dried at 60°C for DM determination. This was later bulked for laboratory analysis. Daily urine output was collected in a plastic container containing 100mls 0.1N H_2SO_4 placed under metabolic crates, 10% of the daily urine output was collected from each buck and stored in the refrigerator. At the end of the 7- day collection period, 10% of the urine taken from each buck was sub sampled and stored in the refrigerator for nitrogen determination (Osuji*et al*., 1993).

Chemical Analysis

Analysis of individual leaves and faecal samples were carried out by AOAC (2000) procedure, Acid detergent fibre (ADF) and Neutral Detergent fibre (NDF) were determined in all the feed ingredients according to Van Soest *etal* (1991). Metabolisable energy (ME) was determined by equation of (Alderman 1985).

ME (MJ/Kg) =11.78 + 0.0064 CP + $(0.000665EE)^2$ - CF (0.00414EE)-0.0118A

Data Analysis

All data collected at the end of the experiment were analyzed using the General Linear Model (GLM) Procedure of Statistical Analysis (SAS, 2002). Significant treatment means were separated using Duncan Multiple Range Test (Duncan, 1955).

RESULTS

Nutrients Digestibility

Table 1depicts the nutrient digestibility of Red Sokoto bucks fed *Ficus thonningii* and *Gmelina arborea* leaves.There was significant difference ($P < 0.05$) across the treatments in all the parameters measured, except for nitrogen free extract. The *Garborea* had significantly ($P < 0.05$) higher coefficient of digestibility of all paramerters measured, except for nitrogen free extract.

Table 1: Digestibility of *F.thonningii* and *G.arborea* leaves

Parameters (%)	*F. thonningii*	*G. arborea*	SEM	LOS
Dry matter	57.03^b	64.26^a	1.69	*
Crude protein	65.27^b	69.10^a	1.86	*
Crude fiber	62.56^b	68.58^a	1.51	*
Ether extract	35.42^b	50.00^a	2.15	*
Nitrogen free extract	98.71	98.72	0.12	NS
Acid detergent fiber	38.27^b	62.27^a	1.81	*
Neutral detergent fiber	64.27^b	73.27^a	1.30	*

^{ab} = Means with different superscript along rows show significant difference (P<0.05), NS= Nosingnificant difference.

Interaction between Digestibility of Unwilted and Wilted *F.thonningii* and *G. arborea* Leaves

Table 2 shows the interaction between nutrient digestibilityof unwilted and wilted *Ficus thonningii* and *Gmelina arborea*l eaves of Red Sokoto bucks.The result showed a significant difference (P < 0.05) across the treatments. Unwilted *Gmelina arborea* was observed to have significantly (P<0.05) higher co-efficient of digestibility of all parameters. Wilted *Gmelina arborea* had significantly (P<0.05) higher co-efficient of digestibility of almost all parameters with the exception of EE (46.67%).Wilted *Ficus thonningii* was shown to have significantly (P<0.05) higher co-efficient of digestibility of all parameters. Unwilted *Ficus thonningii* had significantly (P<0.05) lower co-efficient of digestibility of D.M (11.81%), EE (20.83%) and ADF (9.88%).

Table 2: Interaction between digestibility of unwilted and wilted *F.thonningii* and *G. arborea* leaves

Parameters %	*F. thonningii*		*G. arborea*		SEM	LOS
	Unwilted	Wilted	unwilted	Wilted		
Dry matter	51.81^{c}	62.32^{b}	65.89^{a}	62.64^{b}	1.69	*
Crude protein	57.78^{d}	72.77^{a}	70.43^{b}	67.78^{c}	1.86	*
Crude fiber	56.99^{d}	68.13^{b}	65.23^{c}	71.92^{a}	1.51	*
Ether extract	40.83^{d}	50.00^{b}	53.33^{a}	46.67^{c}	2.15	*
Ash	47.06^{c}	58.84^{b}	58.33^{b}	72.62^{a}	2.12	*
Nitrogen free extract	98.73	98.68	98.73	98.71	0.12	NS
Acid detergent fiber	59.88^{c}	66.67^{a}	62.30^{b}	62.25^{b}	1.81	*
Neutral detergent fiber	57.67^{c}	70.86^{b}	71.66^{b}	74.87^{a}	1.30	*

^{abcd} = Means with different superscript along rows show significant difference (P<0.05). NS= No Significant Difference.

Nitrogen Balance

Table 3 shows the nitrogen balance of Red Sokoto bucks fed *Ficus thonningii* and *Gmelina arborea* leaves**.** There were significant differences (P< 0.05) in all the parameters measured except for faecal nitrogen, nitrogen loss and nitrogen absorbed. *Garborea* had significantly (P<0.05) higher N. intake, N. absorbed and N. retained.

Interaction between Nitrogen Balance of Unwilted and Wilted *F.thonningii* and *G. arborea* Leaves

Table 4 shows the interaction between nitrogen balance of unwilted and wilted *Ficus* and *Gmelina* leaves on the performance of Red Sokoto bucks**.** Animals on unwilted *Gmelina* had significantly higher (P< 0.05) N-intake, while those on unwilted *Ficus thonningii* had the least N-intake. N-loss was observed to be significantly different (P>0.05) from the unwilted ones (*Ficus* and wilted *Gmelina*). N absorbed and N retained were observed to be significantly (P < 0.05) higher in unwilted *Gmelina*.

Table 3: Nitrogen balanceof *F.thonningii* and *G. arborea*leaves

Parameters	*F. thonningii*	*G. arborea*	SEM	LOS
Nitrogen intake (g/d)	11.67[b]	15.67[a]	0.37	*
Faecal nitrogen (g/d)	9.02	8.47	0.86	NS
Urinary nitrogen(g/d)	1.32	1.40	0.55	NS
Total Nitrogen loss (g/d)	10.34	9.87	0.90	NS
Nitrogen absorbed (g/d)	2.65[b]	7.20[a]	0.89	*
Nitrogen retained (g/d)	1.33[b]	5.80[a]	0.93	*
% nitrogen intake	11.39[b]	35.22[a]	2.84	*

[ab] = Means with different superscript along rows show significant difference (P<0.05). NS= No Significant Difference.

Table 4: Interaction between nitrogen balance of unwilted and wilted *F.thonningii* and *G. arborea* leaves

Parameters (g/d)	*F. thonningii*		*G. arborea*		SEM	LOS
	unwilted	wilted	unwilted	wilted		
Nitrogen intake	7.40[d]	15.93[b]	18.47[a]	12.87[c]	0.37	*
Feacal nitrogen	9.90[a]	8.13[b]	8.73[b]	8.20[b]	0.86	*
Urinary Nitrogen	1.43	1.22	1.62	1.18	0.55	NS
Total Nitrogen loss	11.33[a]	9.35[c]	10.35[b]	9.38[c]	0.90	*
Nitrogen absorbed	-2.50[d]	7.80[b]	9.73[a]	4.67[c]	0.89	*
Nitrogen retained	-3.93[d]	6.58[b]	8.11[a]	3.49[c]	0.93	*
% nitrogen intake	-53.25[d]	41.35[b]	43.88[a]	26.56[c]	2.84	*

[abcd] = Means with different superscript along rows show significant difference (P<0.05). NS= No Significant Difference

DISCUSSION

Nutrients Digestibility

There was significant difference (P < 0.05) across the treatments in all the parameters measured, except for nitrogen free extract. All the parameters of *Gmelina arborea* were better digested compared to the *Ficus thonningii*l eaves.This shows the superiority of *Gmelina arborea* leaves over and above the *Ficus thonningii* in terms of the nutrients digestion and utilization by the animals. This agrees with the work of Lowry (1995) who reported that *Gmelina arborea* leaves have a high digestibility, but noted that most of the rumen fermentation occurred very rapidly within the first 24 hours. Abu (2014) reported digestibility values of 30%, 57.63% and 38.05% of CP, DM and NDF respectively, when *Ficus* leaves were fed as a replacement for cotton seed cake in the diet of growing Bunaji Bulls.

The result of this work showed that wilting had no effect on nutrient digestibility of *Gmelina arborea*. Wilting was shown to have effect on nutrient digestibility of *Ficus thonningii*. Wilted*Ficus thonningii* had better nutrient digestibility compared to the unwilted leaves.In a research to determine the effect of partial replacement of maize with *Gmelina arborea* leaves meal in diet of rabbit on growth performance, it was concluded that*Gmelina arborea* was digestible and suitable for rabbit production (Memereole*et al.,* 2007). In another study to evaluate the utilization of *Gmelina arborea* leaves and fruits as feed for sheep, the results of chemical and digestibility study indicated that the leaves were comparable to paragrass in terms of crude protein (12.6% vs 10.0%) and slightly lower in total digestible nutrients (60% vs 70%) respectively (Sevilla and Mariales, 1999).

Nitrogen Balance

There were significant differences ($P< 0.05$) in all the parameters measured except for faecal nitrogen, nitrogen loss and nitrogen absorbed. The nitrogen intake for *Gmelina arborea* was higher than that of *Ficus thonningi*, but the two had statistically similar faecal nitrogen, urinary nitrogen and nitrogen loss. The nitrogen retained and the nitrogen absorbed from *Gmelina arborea* was higher than that of *Ficus thonningii* which translates to the superiority of *Gmelina arborea* leaves over *Ficus thonningii* leaves.

The result of nitrogen balance in red Sokoto bucks fed unwilted and wilted *Ficus thonningii* and *Gmelina arborea* shows that the bucks on unwilted *Gmelina arborea* had the highest utilization of the leaves when compared with their counterparts on the other treatments. It shows therefore that wilting had significant ($p<0.05$) effect on the nitrogen utilization of the bucks especially with *Gmelina arborea*. Wilting was observed not to have any significant ($p>0.05$) effect on *Ficus thonningii* leaves.*Gmelina arborea* was observed to have higher nitrogen utilization when compared with *Ficus thonningii*. Maigandi and Abubakar (2004) reported N-intake of 128.93-138.55 g/d when they fed varying levels of *Faidherbia albida*pods to Red Sokoto bucks.The improved protein utilization and retention observed in the unwilted *Gmelina arborea* leaves is in agreement with the report of Osakwe (2007) that forages with low concentration of condensed tannins could improve the efficiency of N digestion.

CONCLUSION

It could be concluded from the result of this study that *G. arborea* and *F. thonningii* are two browse plants that can be used as feed for Red Sokoto Goats with dry matter and crude protein digestibility greater than 57.0% whether wilted or unwilted form but caution has to be taken while feeding *F. thonningii* if in excess may cause reduce feed intake leading to weight loss by the animals.

RECOMMENDATION

Smallholder farmers and livestock owners can feed their animals with *G. arborea* and *F. thonningii* either wilted or unwilted form with serious caution when feeding wilted *F. thonningii*

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