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EVALUATION OF SELECTED LEAVES OF TREES AND FOLIAGE OF SHRUBS AS FODDER IN RUMINANT PRODUCTION

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ABSTRACT

The potentials of selected leaves of trees and foliage of shrubs as fodder in ruminant production system were evaluated using chemical composition and *in vitro* dry matter digestibility as indices. The selected trees were *Enterolobium cyclocarpum*, *Leucaena leucocephala*, *Moringa oleifera*, *Gliricidia sepium*, *Pterocarpus santalinoides*, and *Millettia grifoniana*, and shrubs were *Stylosanthes scabra*, *Tephrosia bracteolata* and *Lablab purpureus*. The results showed that the chemical compositions of leaves of trees and foliage of shrubs varied significantly ($p < 0.05$) among species. The crude protein (CP) content of the tree leaves ranged from 15.20 to 25.43% for *Pterocarpus santalinoides* and *Moringa oleifera* leaves, respectively, while CP in foliage of shrubs ranged from 21.63 and 26.67% for *Stylosanthes scabra*, and *Lablab purpureus*, respectively. The *in vitro* dry matter digestibilities of these leaves also varied significantly ($p < 0.05$) with the selected trees ranging from 40.80 to 74.75% for *Millettia grifoniana* and *Gliricidia sepium*, respectively while shrubs ranged from 50.35 to 61.24% for *Stylosanthes scabra*, and *Lablab purpureus*, respectively. Results indicated that these forages are highly digestible and their inherent nutrients are higher than the range recommended for maintenance in ruminant production. These fodders can be fed as supplements to low protein forage and can alleviate feed shortages experienced for ruminants in dry season.

Keywords: Ruminant, fodder, tree, shrub, chemical composition, *in vitro* digestibility

INTRODUCTION

Nutrition is the most important consideration in ruminant production systems. Supply of feed in inadequate amount and quality is responsible to a large extent for the low livestock productivity in the tropics. Ruminant animals depend solely on plants for their nutrient requirement in general and energy in particular. As man competes with his livestock for edible grains, forage has been reported (Das and Ghosh, 2001) to contribute about 75% of the dietary needs of ruminants fattened on liberal grain sup-

plement. In areas of the world, where grain feeding is not common, ruminants obtain about 95% of their nutrient requirement from forage.

The feeding value of any forage is a function of characteristics of the species, such as its availability, accessibility and nutrient availability. In ruminant production, the feeding value of forages depends on the balance between available nutrient and the quantity of the nutrient ingested by the animal (Matlebyane, 2005).

Trees and shrubs are important components of ruminant diet (Babayemi and Bamikole, 2006) and they have been found to play an important role in the nutrition of grazing animals in areas where few or no alternatives are available (Meuret *et al.*, 1990; Van *et al.*, 2005). The leaves of *Leucaena leucocephala* and *Gliricidia sepium* plants for instance have been widely reported (Mba *et al.*, 1981; Akbar and Gupta 1985; Larbi *et al.*, 1993; Shelton and Brewbaker, 1994; Fasae *et al.*, 2006) as valuable forage supplements to ruminants consuming low-protein diets. The present report elucidates information on the chemical composition and *in vitro* dry matter digestibility of selected leaves of trees and foliage of shrubs within the campus of the University of Agriculture, Abeokuta, Nigeria as fodder in ruminant production.

MATERIALS AND METHODS

The leaves of six trees, *Enterolobium cyclocarpum*, *Leucaena leucocephala*, *Moringa oleifera*, *Gliricidia sepium*, *Pterocarpus santalinoides* *Milletia grifoniana*, and three shrubs namely *Stylosanthes scabra*, *Tephrosia bracteolata* and *Lablab purpureus* used for this study were harvested by hand from 5 different plants growing within the campus of the University of Agriculture, Abeokuta, Nigeria. The University is located on latitude 7° 15'N and longitude 3° 25'E and 76 meters above sea level in the forest savannah transition zone of South Western Nigeria. It receives a mean annual precipitation of 1,037mm with a mean annual temperature of 34°C and mean relative humidity of 82%.

The leaf samples of each plant were sun dried for five days before taking to laboratory for determination of the dry matter, crude protein and ether extract (AOAC, 1995), neutral detergent fibre, acid detergent

fibre and acid detergent lignin (Van Soest *et al.*, 1994). The *in vitro* digestibility was determined according to Tilley and Terry (1963).

Data generated were subjected to one way analysis of variance using the statistical package of SAS (1999) and significant means were separated (Duncan 1955).

RESULTS AND DISCUSSION

The chemical composition of the selected trees is shown in Table 1. The dry matter (DM) content was highest ($p < 0.05$) in *Milletia grifoniana* (38.50%) and lowest ($p < 0.05$) in *Moringa oleifera* leaves (20.50%). The DM content of leaves from *Moringa oleifera*, *Milletia grifoniana* and *Pterocarpus santalinoides* were similar to such reported elsewhere (Arigbede *et al.*, 2006). The DM content of leaves of *Enterolobium cyclocarpum* was lower than 39.08% (Babayemi and Bamikole, 2006). The variation in DM content among the tree leaves may be attributable to the stage and season of leaf harvest.

The apparent differences in contents of CP among tree species were significant. Values (%) ranged from 15.20 to 25.43 for *Pterocarpus santalinoides* and *Moringa oleifera* leaves, respectively. The value obtained for the CP content of leaves from *Moringa oleifera* is similar to previous report (Oyedele *et al.* 2008), while that of *Gliricidia sepium* leaves falls within the range 18.5 to 26.1 (Carew, 1983) but higher than 15.7% (Bawala *et al.* 2006). However, CP content of *Leucaena leucocephala* and *Enterolobium cyclocarpum* leaves fell within the available range 20.70% to 25.21% and 19.75% to 23.55%, respectively in literature (Odeyinka, 2001; Reddy and Elanchezian, 2008; Oni *et al.*, 2008). The ether extract content was highest ($p < 0.05$) in *Moringa oleifera* leaves (6.6%) and least in *Gliricidia sepium* leaves (1.99%). The highest ash content

Table 1: Chemical composition (%) of leaves from selected trees as fodder in ruminant production

Chemical constituents	Selected					Trees			SEM
	Enterolobium	Leucaena	Moringa	Gliricidia	Pterocarurus	Milletia	Milletia	Milletia	
Dry matter	35.00 ^b	31.65 ^c	20.50 ^e	25.00 ^d	35.02 ^b	38.50 ^a	38.50 ^a	1.52	
Crude protein	20.42 ^b	21.60 ^b	25.43 ^a	19.57 ^{ab}	15.20 ^c	19.45 ^b	19.45 ^b	1.05	
Ether extract	2.14 ^{bc}	3.45 ^b	6.60 ^a	1.99 ^c	2.48 ^c	2.91 ^{bc}	2.91 ^{bc}	0.49	
Ash	7.10 ^d	8.61 ^{cd}	12.61 ^a	10.75 ^{ab}	10.36 ^{bc}	11.36 ^{ab}	11.36 ^{ab}	0.49	
Neutral detergent fibre	64.00 ^b	68.70 ^a	63.27 ^b	52.65 ^c	59.43 ^b	59.67 ^b	59.67 ^b	1.83	
Acid detergent fibre	38.25 ^{ab}	41.20 ^a	41.17 ^a	29.95 ^b	40.32 ^a	36.25 ^{ab}	36.25 ^{ab}	1.41	
Acid detergent lignin	22.75 ^a	10.95 ^c	22.67 ^a	9.75 ^c	14.95 ^b	21.15 ^a	21.15 ^a	1.35	

^{a, b, c, d}, means on the same row with different superscripts are significant ($p < 0.05$).

SEM – Standard error of means

obtained in the study was obtained for *Moringa oleifera* (12.61%) while the least was in *Enterolobium cyclocarpum* (7.10%). The NDF and ADF contents varied among tree species with the highest value of 63.27 and 41.20% , respectively recorded for *Leucaena leucocephala* leaves and the least ($p < 0.05$) content of 56.25 and 29.25%, respectively observed for *Gliricidia sepium* leaves. These values are however, higher than 38.38, 27.11 and 7.86% obtained for NDF and ADF, respectively for *Gliricidia* leaves (Reddy and Elanchezian, 2008). The ADL content was highest in *Enterolobium cyclocarpum* leaves (22.75%) while *Gliricidia sepium* had the least ($p < 0.05$). The NDF observed for *Moringa oleifera* leaves (59.67%) was comparable to the value of 60.70% reported by Arigbede *et al.*, (2006) while the NDF of *Millettia grifoniana* (63.20%) and *Pterocarpus santalinoides* (59.43%) were similar to 60.4 and 60.7%, respectively (Arigbede *et al.*, 2006). The variation observed in the fibre fractions in the studies could be due to species and genotypic differences, stage of growth (Rubanza *et al.*, 2005) and fibre contents due to lignification (Minson, 1990).

Table 2 shows the chemical composition of the selected forage shrubs. The DM contents (%) varied from 23.80 to 36.58. The CP content (%) obtained for the leaves of *Lablab purpureus* (26.67) was significantly ($p < 0.05$) higher than the values obtained for the leaves of *Tephrosia bracteolata* and *Stylosanthes scabra*.

The ether extract content varied among the leaves with *Lablab purpureus* having the highest ($p < 0.05$) value (3.3%) with *Tephrosia bracteolata* having the least (1.42%). Values recorded for the ash in the leaves of *Tephrosia bracteolata*, *Lablab purpureus* and *Stylosanthes scabra* were similar ($p < 0.05$).

The NDF value was significantly ($p < 0.05$) higher in leaves of *Stylosanthes scabra* than *Lablab purpureus* and *Tephrosia bracteolata*. The highest ADF value was recorded for *Lablab purpureus* with least value for *Tephrosia bracteolata* leaves.

The proximate composition and fibre fractions of leaves of trees and shrubs recorded for the present study are comparable with the value reported elsewhere (Senani *et al.*, 1997; Das and Ghosh 2001; Van *et al.*, 2005; Reddy, 2006).

Earlier reports (El-Shatnawi and Mohawesh, 2000; Gatenby, 2002) suggested that ruminants require 7 to 9% CP for maintenance and 10 to 12% for lactation. It seems to be likely that the shrub and tree leaves studied in this experiment as a sole feed or supplement will meet the CP requirements of ruminants for maintenance and lactation since their CP contents were higher than the reported ranges for ruminant requirements.

The *in vitro* dry matter digestibilities (IVDMD) of the leaves of selected trees ranged from 40.80% to 74.75% for *Millettia grifoniana* and *Gliricidia sepium*, respectively (Figure 1) while shrubs ranged from 50.35% to 61.24% for *Stylosanthes scabra*, and *Lablab purpureus*, respectively (Figure 2).

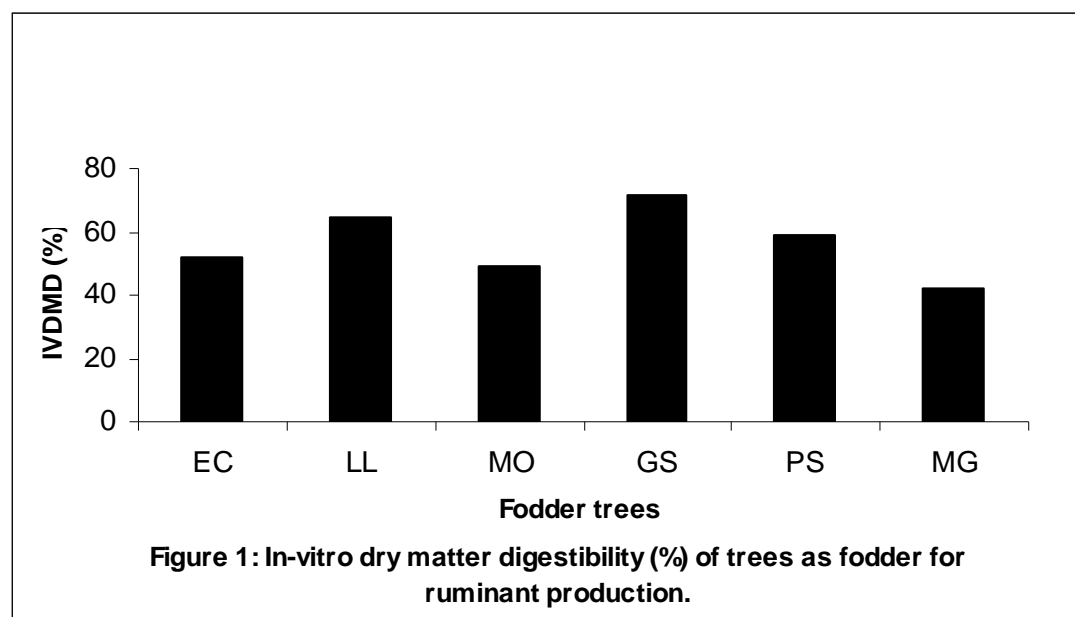
The differences observed in the digestibility of the leaves might be peculiar or due to anti-nutritional factors such as tannins as documented (Getachew *et al.*, 2000, Makkar, 2003 and Murdiati *et al.*, 2005).

The values obtained for IVDMD of various tree and shrub leaves falls within the range reported for fodders like *Alchornea cordifolia* (Benavides, 1999); *Merremia aegyptia*, (Yusuf, 2009); *Olea europaea* (Karabulut *et al.*, 2006)

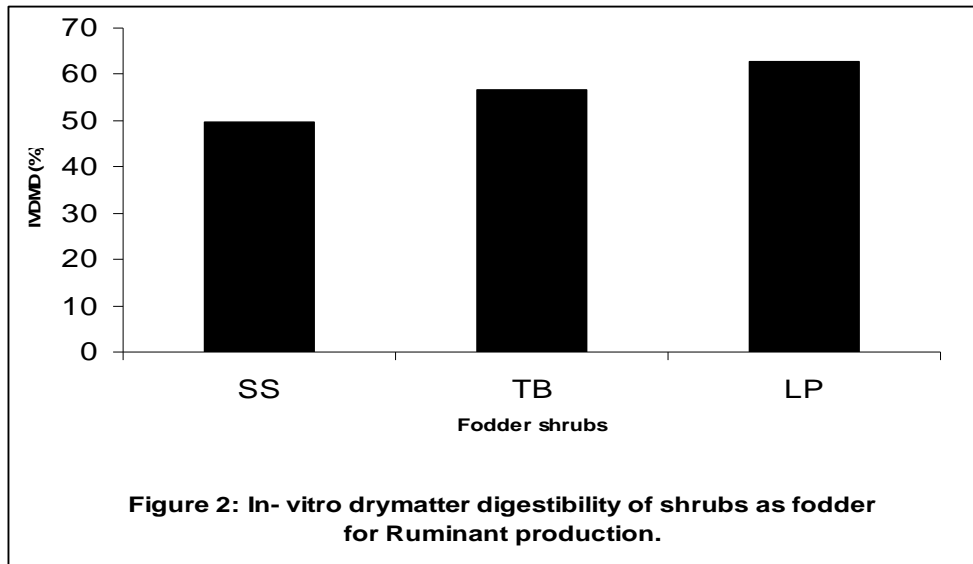
Table 2: Chemical composition (%) of leaves of selected shrubs as fodder for ruminant production

Chemical constituents	Selected			Shrubs
	<i>S.scabra</i>	<i>T.bracteolata</i>	<i>L.purpureus</i>	
Dry matter	36.58 ^a	23.80 ^c	30.00 ^b	1.83
Crude protein	21.63 ^b	22.31 ^b	26.67 ^a	1.10
Ether extract	2.26 ^b	1.42 ^c	3.30 ^a	0.71
Ash	7.70	7.52	7.87	0.12
Neutral detergent fibre	60.95 ^a	50.90 ^b	47.87 ^b	2.32
Acid detergent fibre	29.10 ^{ab}	27.73 ^b	33.83 ^a	1.23
Acid detergent lignin	6.50 ^a	11.31 ^a	7.57 ^a	1.07

^{a, b, c} means on the same row with different superscripts are significantly different ($p < 0.05$). SEM – Standard error of means



EC- *Enterolobium cyclocarpum*, LL- *Leucaena leucocephala*, MO- *Moringa oleifera*, GS- *Gliricidia sepium*, PS- *Pterocarpus santalinoides*, and MG- *Millettia grifoniana*



SS- *Stylosanthes scabra*, TB- *Tephrosia bracteolata* and LP- *Lalab purpureus*

and maize leaves (Fasae *et al.*, 2010) for ruminants.

However, most of these leaves when fed to ruminants have earlier been reported to improve ruminant production. Norton (1994) reported that *Leucaena* supplementation increased rumen ammonia concentration and stimulated microbial protein synthesis in the rumen. Bawala *et al.*, (2006) observed that browse such as *Gliricidia sepium* fed to goats enhanced performance as reported elsewhere (Fasae *et al.*, 2006) for the foliage of *Gliricidia sepium*. Acceptability of *Enterolobium cyclocarpum* leaves as a source of high quality nutrients for goats has also been reported to improve the utilization of citrus pulp at 50% level of inclusion in the diets (Oni *et al.*, 2008).

Sarwatt *et al.* (2004) reported that decreasing the level of sunflower seedcake and replacing it with *Moringa oleifera* leaf meal increased the voluntary dry matter intake of goats particularly between 25 to 50% inclusion and

concluded that the optimum economic level of substitution was 50% inclusion. Cattle fed up to 40% inclusion of *Moringa oleifera* leaves in their diets however did not enhance performance (Nouala, 2004). Feeding of lablab as a supplement to oat hay recorded average daily gain in sheep which was almost double that of animals on the basal diet (Umunna *et al.*, 1995).

In addition, the supplement of *Tephrosia bracteolata* foliage as a legume increased digestibility of poor roughages and voluntary DM intake (Mossi and Butterworth, 1985). Goats and sheep on range and in pens showed preference for *Tephrosia bracteolata* leaves (Babayemi and Bamikole, 2006).

CONCLUSION

The study revealed that the nutrient compositions of these forages are higher than the range recommended for ruminant production. The relevance of evaluating the chemical compositions of the selected trees and

shrubs is evident as their leaves can make important contribution to ruminant production. These fodders can alleviate some of the feed shortages experienced in ruminant production especially in the dry season.

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