MINERAL PROFILE OF FOUR SELECTED TREE FORAGE SPECIES CONSUMED BY SMALL RUMINANTS IN THE SOUTH-WESTERN NIGERIA

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ABSTRACT
The presence of both major and trace minerals of four selected tree fodders in the south-western Nigeria often recommended for use as non- conventional feeds for ruminants was assessed. Fresh samples of *Ficus sur, Bridelia micrantha, Gmelina arborea* and *Albizia saman* were harvested from arboretum of Federal University of Agriculture, Abeokuta, Nigeria. Mineral constituents were analysed using atomic spectrophotometer and flame photometer. Results indicated that *B.micrantha* recorded least ($p < 0.05$) Magnessium (0.69%) and Sodium (1.17%) contents with intermediate Phosphorus value of 0.57%, highest Potassium level of 1.80% and copper of 14.83ppm among the selected forages. Calcium content ranged from 3.07 in *A. saman* to 3.79% in *F.sur*. However, iron (711.17 ppm), Calcium (3.79%), Zinc (58.67 ppm) and Manganese (139.82 ppm) contents were more in *F.sur*. Considering the mineral profiles of these tree forage species, they can all serve as good feed resource to ruminants.
Keywords: *Albizia saman, Bridelia micrantha, Ficus sur, Gmelina arborea,* Mineral profile,

INTRODUCTION
Tree fodders are important sources of high quality feed for grazing ruminants and as supplements to improve the productivity of herbivores fed on low quality feed (Mokoboki, 2011). They are important in providing nutrients to grazing ruminants in arid and semi-arid environments where inadequate feeds are major constraint for livestock production. Use of tree leaves in ruminant enhances microbial growth and digestion (Bonsi *et al.,* 1995).Tree fodders maintain higher protein and mineral contents during growth than grasses which decline rapidly in quality with progress in maturity (Aganga and Tshwenyane, 2003). A good number of forage species have been noted as being useful as livestock feeds (Adegbola and Okonkwo, 2002).
Minerals form an integral part of functionally important organic compounds such as iron (Fe) in haemoglobin or zinc (Zn) in insulin (Delvin, 1997). Mineral deficiencies have manifested in forms of different disease conditions such as goitre, rickets and one form of metabolic dysfunction or the other (Prohp *et al.,* 2006). Despite the amount of researches carried out with non-conventional feeding materials, which could have a major impact on livestock production, they continue to be unused or under-utilized. A critical factor in this regard has been the lack of proper understanding of their nutritional and mineral components. This study was therefore, carried out to critically examine both major and trace minerals of some selected tree forages in the savanna agro-ecological zone of South-western Nigeria.

Materials and methods
Four tropical tree fodders (*Ficus sur, Bridelia micrantha, Gmelina arborea* and *Albizia saman*) eaten by small ruminants (West African dwarf Goat and Sheep) were used for this study. Samples were harvested from mature plants within the arboretum of the Federal University of Agriculture, Abeokuta, South-western, Nigeria. Each collected fresh sample consisted of leaves and small part of stems. The samples were wilted overnight and then oven-dried at 65°C for 48 hour, milled with the aid of milling machine and then sieved through 2mm mesh sieves. Milled samples of about 300 g were sealed in cellophane bags and stored until required for analysis.
The ground samples were subjected to wet digestion of nitric acid and perchloric acid after which the Iron, Zinc, Copper, Calcium, Magnesium and Manganese content of the samples were analysed using Atomic absorption spectrophotometer. Sodium and potassium contents were determined with the use of flame photometer (AOAC 2005) while Phosphorus was determined by spectrophotometer. All analyses were carried out in six replicates and reported as means of values on a dry weight basis.
All data collected were subjected to one-way Analysis of Variance (ANOVA) while significant differences among means were compared using Duncan's Multiple Range Test (SAS 1999).

$Y_{ij} = \mu+T_i +\varepsilon_{ij}$ Where Y_{ij}= Output, μ= population mean, T_i= mean effect of selected forages, ε_{ij}=Residual error

RESULTS AND DISCUSSION

Table 2 presents the major and trace mineral components of selected tree forage species. There were significant differences ($P < 0.05$) in the mean values of major minerals considered across the selected tree forages except Sodium. Calcium level ranged from 3.07 – 3.79% in *A.saman* and *F.sur* respectively; these values were higher when compared to the reported values for *T.diversifolia* (0.89%) and *N. laevis* (0.55%) by Yusuf *et al.* (2013). Ahamefule *et al*. (2006) reported lower Calcium contents (1.88, 1.16 and 1.00%) in *Alchornea cordifolia*, *Urena lobata* and *Asystacia gangetica* respectively compared to the observed values of the understudied tree forages. All the forages investigated recorded calcium level above 0.20% recommended for maintenance in sheep as well as above the recommended value (0.51%) for finishing lambs (4 – 7 months old) (NRC, 1985). Phosphorus also known as "master mineral" is involved in most metabolic processes (Rasby *et al.*, 1997). The least value (0.46%) recorded for Phosphorus in *A.saman* among the investigated plants was higher than the recommended range of Phosphorus (0.12 to 0.48%) for all classes of ruminants as stated by NRC (1985). However, Ahamefule *et al*. (2006) reported similar value (0.50%) for phosphorus in *Gmelina arborea*. The Magnesium content of the selected tree plants ranged from 0.69 – 0.91% in *B.micrantha* and *F.sur* respectively which was also above the recommended values (0.12 – 0.18%) for Sheep (NRC 1985). These values were higher compared to the value (0.31%) reported by Ologhobo (1989) for forage legumes consumed by goats in Nigeria. Values (1.35 – 1.80%) reported for Potassium in *A.saman* and *B.micrantha* respectively were higher than 0.5% required for non-lactating goats (NRC 1981) and as well above 0.80% recommended for lactating goats (NRC, 1981). Variations observed in the mineral constituents of the tree forages investigated when compared with other researcher's results could be attributed to the season in which the forage legumes were collected coupled with the soil characteristics and age at harvesting (Ajayi 2012). For trace minerals, *Albizia saman* had the least Iron content (397.50ppm) while the highest ($P < 0.05$) value was observed in *F.sur* (711.17ppm). Iron content of all the selected plants examined were above the level recommended for goats (350 ppm) (NRC, 1981). The values observed in the selected browse forages negate the report of Ologhobo (1989) that most legumes contained less than 350 ppm iron. *Ficus sur* had highest ($P < 0.05$) Zinc content (58.67 ppm) while the least value obtained in *G.arborea* (49.33 ppm) was similar to 45 ppm of Zinc recommended for small ruminants (Mba, 1981). The range of Manganese concentration obtained in the selected forages fell within the reported values (01 – 2670ppm) obtained in pastures by Minson (1990). It has been reported that Manganese deficiency causes impaired growth, skeletal and infant abnormalities in livestock (Hussain and Durrani, 2008). However, excessiveness of Manganese decreases the appetite in animals (Danbara *et al.*, 1985). Copper is vital in the formation of bones and act as key component of several enzymes in plants. Copper deficiencies symptoms differ in different species of animals and problem of anaemia is common along with abnormalities of bones and depressed growth as reported by Sher *et al*. (2011). The range of copper obtained was similar to that required for ruminant (06 – 12ppm) as reported by Ensminger and Olantine (1987). All the browse forages investigated contained appreciable quantity of minerals which can supplement grassland pasture for adequate nutrient intake by animals

CONCLUSION

Values recorded for all minerals investigated were adequate to meet the requirement for growth, reproduction and milk in West African dwarf sheep and goats. Therefore, mineral supplementation would seem not important while feeding animals with these plants since they contained more than required amount for small ruminants production.

Table 1: Chemical and fibre composition (%) of the selected tree forage species

Samples	CP	CF	ASH	EE	DM	OM	NDF	ADF
F. sur	23.67[a]	16.20[b]	8.44[a]	6.65[c]	23.52[d]	91.56[b]	38.07[b]	33.62[a]
B. micrantha	19.09[b]	14.85[b]	3.05[b]	9.05[b]	36.09[b]	96.95[a]	38.53[b]	19.02[b]
G. arborea	16.56[b]	8.45[c]	2.66[b]	11.52[a]	27.74[c]	64.01[c]	41.05[b]	34.72[a]
A. saman	18.88[b]	20.60[a]	8.27[a]	3.83[d]	39.45[a]	91.71[b]	46.12[a]	35.39[a]
SEM	0.86	1.33	0.85	0.89	1.46	3.90	1.05	2.07

[abcd]*Means in the same column having different superscripts are statistically different at p < 0.05, SEM: Standard Error of Mean, CP: Crude protein, CF: Crude fiber, EE: Ether extract, DM: Dried matter, OM: Organic matter, NDF: Neutral detergent fibre, ADF: Acid detergent fibre*

Table 2: Major and trace mineral components of the selected tree forage species

Parameters	Tree forage species				
	B. micrantha	*A. saman*	*F. sur*	*G. arborea*	SEM
Major minerals (%)					
Magnesium	0.69[b]	0.78[ab]	0.91[a]	0.89[a]	0.04
Calcium	3.58[b]	3.07[c]	3.79[a]	3.73[ab]	0.09
Phosphorous	0.57[ab]	0.46[b]	0.69[a]	0.53[b]	0.03
Sodium	1.17	1.38	1.23	1.53	0.07
Potassium	1.80[a]	1.35[b]	1.43[b]	1.43[b]	0.06
Trace minerals (ppm)					
Zinc	52.93[ab]	53.00[ab]	58.67[a]	49.33[b]	1.33
Manganese	107.83[b]	93.67[c]	139.82[a]	138.32[a]	6.06
Iron	450.50[b]	397.50[c]	711.17[a]	461.67[b]	36.71
Copper	14.83	13.67	14.68	13.62	0.38

[abc]*Means on the same row having different superscripts are statistically different (P < 0.05), SEM-standard error of means*

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