

Chemical Composition of Selected Green Plants Available to Small Ruminants in the Dry Season in Humid Nigeria.

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Summary

Chemical analysis to assess the mineral status of fifteen randomly sampled mature dry season plants available for grazing by small ruminants in the humid tropics of Nigeria was carried out. A minimum mineral nutrient composition of 9.19, 0.22, 0.20, 0.07, 1.17, 0.02% DM for CP, Ca, Mg, P, K and Na respectively was observed with the macro nutrients while the micro minerals Mn, Fe, Cu, and Zn respectively contained the minimal values of 24.27, 58.10, 2.27 and 7.90 mg per kg DM.

The composition of the plants for crude protein, Ca, Mg, K, Mn and Fe were found adequate for sheep production. On the contrary P, Na, Cu and Zn were inadequate. An allowance of cereal grains and/or provision of supplemental mineral salt blocks to provide these deficient minerals is strongly suggested in this area during the dry season.

Résumé

Des feuilles de quinze plantes échantillonnées au hasard et trouvées dans la région tropicale humide du Nigéria, pour la consommation des petits ruminants en pleine saison sèche, ont été analysées pour leur teneur en dix éléments suivants: Azote (N), Calcium (Ca), Magnésium (Mg), Phosphore (P), Potassium (K), Sodium (Na), Manganèse (Mn), Fer (Fe), Cuivre (Cu) et Zinc (Zn). La teneur en protéine brute (PB) a été estimée par le produit valeurs de l'Azote (N) fois le facteur 6.25. L'analyse a révélé la composition chimique minimum suivante: 9.19, 0.22, 0.20, 0.07, 1.17, et 0.02% pour CP, Ca, Mg, P, K, et Na respectivement. Tandis que le Manganèse (Mn), le Fer (Fe), le Cuivre (Cu) et le Zinc (Zn) avaient les teneurs de 24.27, 58.10, 2.27 et 7.90 mg/kg M.S. respectivement.

La teneur en éléments utiles aux petits ruminants paraissait assez suffisante en PB, Ca, Mg, K, Mn et Fe dans les plantes examinées. Cependant, pour des petits ruminants, P, Na, Cu et Zn étaient en quantités insuffisantes dans toutes les plantes herbacées et dans 50% des herbes sélectionnées avec les feuilles de l'arbre non-légumineux, le Terminata catapa.

En plus, la teneur en Mn, Fe, Cu, et Zn était trop faible dans les plantes analysées. Un supplément en éléments déficitaires dans la région humide du Nigéria, pendant la saison sèche, est vivement recommandé.

Introduction

The role of poor nutrition in the underdevelopment of all classes of livestock in the tropics is a well known fact. Ruminants, small and large alike, in no small way depend on the consumption of forages and browses for optimal productivity. With the increasing demand for meat from sheep and goats in Nigeria (12), the small ruminant, from the point of view of relatively lower cost of nutrition, seems most attractive to produce. Besides, they contribute over 30% of the meat consumed in Nigeria (1). The humid tropic of Nigeria is known to house an estimated 22 million goats and 9 million sheep (4). Together, they account for about 53% of the grazing ruminant population, with over 70% of rural house holds in South Western Nigeria known to keep sheep and/or goats (6). Productivity by these animals is generally low (3) particularly

because a majority of them are free roaming in search of food.

Typically, ambient temperatures and rainfall in humid Nigeria are bimodally distributed with a rainy season (March - October) characterized by lush forages and a dry season (November - February) comprising mature vegetation. The effect of maturity on chemical composition of forages have been well documented (5, 13, 14). Although it is inaccurate - to ascribe deficiencies in nutrients to geographical location, mineral deficiencies have earlier been observed to be most often dependent as well as influenced by geographical region (8). The aim of this investigation was to provide information on the mineral status of some green plants available to these free roaming small ruminants in the dry season in humid Nigeria.

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Material and Methods

The green leaves of fifteen common plants were collected at maturity and in their natural stands at the end of December, 1993, about the middle of the dry season, from seven locations in and around Abraka (Lat. 5° 4' N; Long. 6° 6' E) in the tropical rainforest of Nigeria. The sampled plants comprised *Sporobolus pyramidalis* P. BEAUV., *Eleusine indica* GAERTH., *Axonopus compressus* (SWARTZ) P. BEAUV., *Calopogonium mucunoides* DESV., *Pueraria phaseoloides* (ROSB.) BENTH., *Vigna unguiculata* (L) WALP., *Cajanus cajan* (L) MILLSP., *Gliricidia sepium* (JACQ) WALP., *Musa sapientum* LINN., *Musa paradisiaca* LINN., *Manihot palmata* MUELL., *Carica papaya* LINN., *Mangifera indica* LINN., *Terminalia catapa* LINN. and *Sida acuta* BURM. f. Twenty-five leaves of each plant were randomly plucked from each location, bulked in separate polythene bags and adequately labelled for laboratory analysis.

Each bulked sample was oven-dried at 60°C for 48 hours to a constant weight. Two representative sub-samples each were then taken from the sample of each plant and separately milled in a porcelain mortar to pass through a 1mm mesh before they were chemically analysed and the average mineral content recorded. Ca, Mg, P, Fe, Zn, Cu, and Mn concentrations were determined using the atomic absorption spectrophotometer while K and Na were read off flame photometer after digestion. Total nitrogen was determined by Kjeldahl's method and the values obtained were multiplied by the factor 6.25 to obtain the crude protein content. All analytical procedures followed were as specified by the Association of Official Analytical Chemists (2).

Results and Discussions

The crude protein, macro and micro mineral content of the analysed dry season green leaves are presented in table 1.

Analysis revealed an average crude protein content of 18.13% in all the leaves. This ranged between a low of 9.19% in *Sporobolus pyramidalis* to a high of 28.69% in *Carica papaya*. Barring other factors that may affect protein utilization, these crude protein values appear adequate for sheep and goats in this area based on recommended protein levels of between 6.6 and 12% (11)

The level of calcium in the plants ranged from 0.22% (*Eleusine indica*) to 2.84% in *Carica papaya*. With a recommended calcium range of 0.21 - 0.52% for sheep and goats (11) it is thus not a limiting mineral in the dry season.

An average magnesium level of 0.38% was observed from analysis. Magnesium thus seemed adequate based on the fact that all the plants had levels higher than the minimum requirement of 0.04% (11).

Phosphorus content varied from 0.07% (*Mangifera indica*) to 0.32% (*Carica papaya*). Two fifths of the plants fell below the critical range for phosphorus of 0.16 - 0.37% for sheep and goats (11). This observation confirms phosphorus as one of the most likely nutritional deficiencies of grazing animals (7) as well as its low levels in tropical forages (9). Cereal grains or supplemental phosphates should be provided sheep in this area during the dry season to check this apparent deficiency.

Results in table 1 reveal an abundance of potassium in the plants for sheep and goats with reference to the recommended level of 0.05% (11). *Mangifera indica* had the least content of potassium with 1.17%. Similar investigations carried out on tropical forages in the West Indies (15) agree with the finding above.

Based on the recommended range 0.04 - 0.10% for sheep (11), sodium was observed to be marginal to inadequate in roughly 60% of the sampled leaves. This is similar to a study with grasses in Cameroon (10) Thus, sheep in this area should be allowed free access to common salt during this season.

Table 1 : Crude protein, macro and micro mineral content (DM) of selected Green Plants of Abraka, Nigeria, in the dry season.

Scientific Name	%						mg/kg			
	C.P**	Ca	Mg	P	K	Na	Mn	Fe	Cu	Zn
<i>Sporobolus pyramidalis</i>	9.19	0.62	0.29	0.10	2.43	0.04	24.27	114.90	5.00	134.54
<i>Eleusine indica</i>	12.94	0.22	0.24	0.14	2.94	0.05	131.03	65.62	4.11	156.00
<i>Axonopus compressus</i>	12.31	0.71	0.33	0.20	2.40	0.04	35.44	115.04	6.31	24.00
<i>Calopogonium mucunoides</i>	24.31	1.19	0.20	0.13	2.07	0.04	114.11	112.00	10.90	108.60
<i>Pueraria phaseoloides</i>	22.50	1.11	0.25	0.15	1.59	0.03	55.00	192.06	2.27	109.09
<i>Vigna unguiculata</i>	16.19	2.39	0.33	0.15	3.90	0.09	30.60	121.00	8.49	118.00
<i>Cajanus cajan</i>	21.06	0.82	0.24	0.18	1.47	0.03	48.31	133.40	8.40	41.70
<i>Gliricidia sepium</i>	20.19	1.96	0.41	0.17	3.23	0.07	61.42	127.66	4.70	21.01
<i>Musa sapientum</i>	16.50	0.77	0.48	0.19	5.85	0.11	30.01	120.40	4.00	26.00
<i>Musa paradisiaca</i>	13.69	0.62	0.40	0.18	3.75	0.07	111.05	178.60	3.24	40.00
<i>Manihot palmata</i>	26.79	1.07	0.26	0.21	1.83	0.04	55.14	58.10	6.14	64.20
<i>Carica papaya</i>	28.69	2.84	1.16	0.32	2.85	0.07	26.23	62.80	3.34	34.10
<i>Mangifera indica</i>	11.06	2.82	0.31	0.07	1.17	0.02	185.04	112.50	5.06	26.00
<i>Terminalia catapa</i>	18.94	1.72	0.32	0.19	2.43	0.05	29.08	68.60	12.30	32.00
<i>Sida acuta</i>	17.56	2.36	0.50	0.27	3.53	0.08	91.00	108.30	5.23	7.90
Sheep Mineral Requirement*	6.6-12	0.21-0.52	0.04-0.08	0.16-0.37	0.05	0.04-0.10	20-40	30-50	5	35-50

* NRC 1975

** C.P. Crude Protein

Manganese and Iron were observed to be generally high and adequate for sheep with reference to the recommended levels of 20 - 40 mg/kg and 30 - 50 mg/kg respectively.

Copper levels varied widely from 2.27 - 12.30 mg/kg. Based on the recommended copper level of 5 mg/kg, the plants individually were marginally adequate for sheep (11). Also based on the recommended range of 35 - 50 mg/kg for Zinc, the plants were also observed to be marginally adequate for sheep with more than 40% falling below the minimum recommended level. Trace mineralized salt blocks enhanced with copper and zinc are recommended for grazing sheep in this area.

The leaves from legumes were generally good protein sources. *Carica papaya*, although not a conventional feedingstuff for small ruminants in this area, was observed to have the highest values in crude protein, Ca, Mg and K. This is an interesting point in terms of balancing these nutrients that may be deficient in other forages eaten by these animals. On the other

hand, *Mangifera indica* was found to supply the least levels of P, K, Na and Mn. Adequate precautions should therefore be taken in feeding this tree leaf to sheep and goats. Toxic levels of Cu (11) were found present in the tree leaf *Terminalia catapa* and in 60% of the legumes viz: *Calopogonium mucunoides*, *Vigna unguiculata* and *Cajanus cajan*.

Conclusion

This analysis revealed adequate concentrations of crude protein, Ca, Mg, K, Mn and Fe in the plants studied, for small ruminant production. However, deficiencies were observed with phosphorus sodium and copper as earlier reported by Loosli (7) with grazing animals together with Zinc in this study. The supply of supplemental mineral salt blocks to provide these deficient minerals during the dry season will in no small measure help to correct the situation. Besides, the use of these plants as feed should be done in such a way that maximum advantage is taken during the dry season based on their chemical composition.

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