MINERAL CONSTITUENTS OF SOME BROWSE PLANTS USED IN RUMINANT FEEDING IN SOUTHERN NIGERIA

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(Received 3 March 1988; accepted for publication 9 November 1988)

ABSTRACT

Thirty-six browse plants found in natural pastures and used in small ruminant feeding were collected during the dry season. Their leaves were assayed for their contents of macro- and micro-mineral elements.

Mg, Ca, Na, Cl and K contents were noticeably high with overall mean levels of 0.35, 0.44, 0.059, 0.05 and 1.61% respectively while those for Zn, Fe, Mn and Cu were respectively 79.28, 803.39, 588.64 and 13.08 ppm in the leaves.

Most of the leaves had moderate Ca: P ratios though *Terminalia catapa* leaves had as high a ratio as 42 while the overall mean Ca/P was 4.49 ± 1.19. P., Cu and Zn were however low in some of the browse leaves.

Key Words: Browse, Trees, Shrubs, Herbs, Macro/Micro mineral, ruminant feeding.

INTRODUCTION

The importance of forage legumes has been emphasized over the years (Le Houérou, 1980; Onwuka, 1985) and they form a very important part of goat's diets especially in the rural areas of Nigeria. Browse abound in the sub-saharan region of Africa but there is very scanty information on their compositional analyses especially Na, and trace elements (Agishi, 1985; Le Houérou, 1980).

The presence of mineral elements in animal feed is vital for the animals' metabolic processes. Grazing livestock from tropical countries often do not receive mineral supplementation except for common salt and must depend almost exclusively upon forage for their mineral requirements (McDowell *et al.*, 1984). Mineral deficiencies or imbalances in soils and forages account partly for low animal production and reproductive problems.

Browse can be used directly by grazing livestock: cut and fed to animals in stalls; dried and included in rations. This research report supplements the few existing work on minerals levels in trees, shrubs and herbs used in animal feeding in the tropics.

MATERIALS AND METHODS

The leaves of thirty-six browse plants made up of 15 trees, 11 shrubs and 10 herbs were collected from the humid and sub-humid regions of Nigeria in the dry season months between November and March.

The *Manihot spp.* leaves were 10 months old while the other plants ranged from 1-5 years. The identification of the leaves with their inflorescence (where necessary) was done in the Botany, Forestry Departments and Botanical garden of the University of Ibadan, Nigeria; the National Institute of Horticultural Research (NIHORT), Ibadan as well as the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria which also provided the different clones of *Manihot spp.*

The samples were first washed in water to remove extraneous matter such as dust and then dried at 60°C for 2-3 days in a forced-air draught oven before milling. Mg, Zn, Cu, Fe and Mn were determined using the Perkin-Elmer Atomic Absorption Spectrophotometer. Na, K and Ca were determined with the Flame photometer while P and Si were assayed according to the AOAC (1975) methods of analysis.

RESULTS AND DISCUSSION

Tables 1, 2 and 3 indicate that the leaves of the trees, shrubs and herbs analysed were fairly low in their P contents. McDowell (1984) stated that P is deficient in ruminant forage in Nigeria among other tropical countries. These values compare favourably with those obtained by Dougall and Bogdan (1958); Le Houérou (1980) and Agishi (1985) who also worked on tropical forages. results obtained for Ca were lower than those cited by Le Houérou (1980). This could have resulted from the season the leaves were collected coupled with the fact that most of the soils in South Eastern Nigeria are predominantly acidic in pH (Udo, E.J., 1986 – Personal Communitation). Fleming (1973) mentioned soil acidity and season as factors that affect mineral uptake by plants.

Ca/P ratios were moderate in most of these browse species except for *terminalia catapa* which was exceptionally high (Table 1). NRC (1971, 1976 & 1981) recommended a A-P ratio between 1 and 2 for ruminants and this is far exceeded by most of the analysed species. This difference may have resulted from the low P values in these browse species.

Mg values were fair while K levels were noticeably high i.e. more than 1% level of K in three-quarters of all plants analysed. Na and Cl were quite low as indicated in Tables 1, 2 and 3. This could explain why NaCl supplementation is advised in goat and sheep nutrition where browse is the sole feed. Fe supplementation would not be necessary since most of these leaves had high contents of Fe.

Cu and Zn were generally low in the browse plants and this tends to buttress the earlier claims of Carew (1982) as regards the deficiency of Cu and Zn in *Gliricidia sepium*.

However, the values obtained for Na, K, Zn, Fe, Cu, and Cl (in all the Tables) for trees, shrubs and herbs are higher than those cited by Le Hou
rou (1980) for some grass species and this is in line with the findings of Fleming (1973). The low levels of Zn, Cu, and Cl in *Gliricidia sepium* show that when this browse is fed to ruminants, supplemental levels of these minerals would be required according to McDowell *et al* (1978).

The overall means and the ranges of these minerals in the leaves are summarized in Table 4. Values obtained for most of the mineral in these species show that the browse can meet the mineral requirements of ruminants (NRC 1971, 1976 & 1981) except for Cu, Zn and P.

Table 1
Mineral contents of some Nigerian (Browse) Trees Leaves

Scientific Names	% P	% C	% Mg	% K	% Na	% Cl	% Si	Zn (ppm)	Fe (ppm)	Mn (ppm)	Cu	Ca: P
Baphia nitida (Lodd)	0.15	0.15	0.15	1.39	0.050	0.08	1.04	–	860	560	73	1.00
Parinari kerstingii (Engl.)	0.11	0.30	0.17	0.96	0.050	0.05	0.52	65	620	610	11	2.73
Acioa barterii (Hook F)	0.17	0.24	0.73	0.53	0.050	0.07	2.07	85	390	600	Trace	1.41
Ceiba pentandra (Gearin.)	0.12	0.18	0.19	0.32	0.050	0.09	1.52	40	350	190	Trace	1.50
Crypsophylum albidium	0.06	0.46	0.17	0.41	0.050	0.06	0.55	–	800	810	11	7.67
Dialium guineensis (Willd)	0.12	0.66	0.33	1.55	0.050	0.02	6.42	87	940	1,420	11	5.50
Albizia adianthifolia (Schum)	0.07	0.13	0.16	1.08	0.050	0.11	2.60	–	1,700	670	21	1.86
Albizia zygia (DC)	0.27	0.23	0.42	2.92	0.052	0.07	0.51	66	1,830	184	10	0.85
Cassia siamea (Lam)	0.08	1.20	0.26	0.98	0.050	0.04	2.55	45	820	80	Trace	15.0
Terminalia catapa (Linn)	0.03	1.27	0.81	1.45	0.100	Trace	4.07	65	500	44	10	42.33
Samanea saman (Merill)	0.47	0.14	0.27	4.34	0.050	0.06	0.53	107	1,230	670	21	0.30
Elaeis guineensis (Jacq.)	0.08	0.25	0.16	1.43	0.053	0.04	2.65	–	610	150	11	3.13
Parkia clappertoniana (Keay)	0.16	0.15	0.16	3.02	0.053	0.06	1.59	52	690	43	120	0.94
Spondias mombin (Linn)	0.27	0.29	0.41	3.13	0.056	–	2.24	88	2,100	100	11	1.07
Gliricidia sepium (Jacq.) Walp.	0.30	0.95	0.46	3.36	0.030	–	–	21	300	80	5	1.17
(Mean)	0.16	0.44	0.32	1.79	0.053	0.05	2.06	65.55	916	414.07	21	5.90
(Standard Error)	0.03	0.10	0.05	0.32	0.004	0.01	0.44	7.57	144.07	101.50	8.40	2.78

All results expressed on dry matter basis.
– = not available.

Table 2
Levels of macro and micro mineral elements in some Nigerian shrubs

Scientific Names	% P	% C	% Mg	% K	% Na	% Cl	% Si	Zn (ppm)	Fe (ppm)	Mn (ppm)	Cu	Ca: P
Microsdesmis puberula (Hoof f.)	0.08	0.57	0.18	1.13	0.054	0.09	2.15	–	720	680	11	7.13
Alchornea cordifolia (Schm. & Thornn)	0.12	0.24	0.16	0.89	0.081	0.05	0.54	50	570	490	22	2.00
Cnestis ferrugines (DC)	0.08	0.62	0.17	1.06	0.053	0.04	1.59	–	790	860	21	7.75
Carpobobia lutea (G. Don)	0.08	0.21	0.19	0.53	0.051	0.07	1.01	85	390	600	Trace	2.63
Bridelia ferruginea (Benth.)	0.12	0.31	0.30	0.93	0.051	0.09	3.57	40	3,200	270	Trace	2.58
Sacrocephalus esculentus	0.08	0.10	0.48	0.53	0.030	0.08	3.56	63	470	790	10	1.25
Musanga cecropoidea	0.21	0.89	0.61	2.14	0.030	Trace	–	15	556	2,578	5	4.24
Combretum paniculatum (Vent)	0.14	0.20	0.16	2.01	0.054	0.01	1.08	–	800	790	11	1.43
Codiaeum variegatum (Linn)	0.11	0.71	0.64	2.14	0.332	Trace	4.60	46	600	170	Trace	6.46
Alchornea spp. (Raffn)	0.08	0.30	0.29	1.10	0.054	0.02	0.54	39	400	1,490	Trace	3.75
Cola milenii (K. Schum.)	0.28	0.81	1.03	2.51	0.054	0.04	1.62	92	1.960	2,000	32	2.89
(Mean)	0.13	0.45	0.38	1.36	0.077	0.05	2.03	53.75	590.55	974.36	10.18	3.83
(Standard Error)	0.02	0.08	0.08	0.21	0.026	0.01	0.45	8.97	260.28	225.13	3.27	0.69

– = not available
(All results on Dry matter basis)

Table 3
Mineral contents of some herbs in Nigeria

Scientific Names	% P	% C	% Mg	% K	% Na	% Cl	% Si	Zn (ppm)	Fe (ppm)	Mn (ppm)	Cu	Ca: P
Aframomum me'egueta (Rose) K. Schum.	0.06	0.09	0.15	0.98	0.053	0.05	1.59	–	530	220	11	1.50
Palisota hirsuta (K. Schum)	0.10	0.71	0.17	1.34	0.054	0.05	4.82	–	820	1,500	11	7.10
Costus afer (Ker-Gawl)	0.15	0.19	0.17	2.04	0.054	0.09	2.15	–	820	940	11	1.27
Manihot esculenta (Pohl) (Clone No. 30211)	0.22	0.04	0.45	1.53	0.026	0.10	1.53	43	210	60	Trace	0.18
Manihot esculenta (Pohl) (Clone No. 60506)	0.23	0.22	0.46	1.84	0.025	0.02	1.52	68	220	92	Trace	9.96
Manihot esculenta (Pohl) (Clone No. 30337)	0.16	0.80	0.49	1.61	0.051	0.04	2.55	550	300	92	Trace	5.00
Manihot esculenta (Pohl) (Clone No. 51077)	0.25	0.77	0.40	1.72	0.051	0.05	1.01	60	280	87	Trace	3.08
Manihot esculenta (Pohl) (Clone No. 40764)	0.17	0.79	0.48	1.67	0.051	0.02	2.53	76	300	81	Trace	4.65
Marantochloa leucantha (K. Schum)	0.06	0.20	0.44	1.22	0.051	0.02	6.64	34	450	540	Trace	3.33
Musa sapientum (Linn)	0.08	0.32	0.16	2.02	0.053	0.05	3.72	–	940	670	11	4.00
(Mean)	0.15	0.41	0.34	1.60	0.047	0.09	2.81	138.50	487	426.2	4.40	3.11
(Standard Error)	0.02	0.10	0.05	0.11	0.004	0.04	0.56	82.55	87.62	153.92	1.80	0.68

(All results expressed on Dry matter basis).
– = not available.

Table 4
Summary of the means and ranges of minerals contained in some browse species in Nigeria

Mineral element	Overall mean in the Browse	Ranges	Requirements*
8P	0.15 (0.02)%	0.03 – 0.47%	0.16 – 0.37%
Ca	0.44 (0.06)%	0.04 – 1.27%	0.18 – 1.04%
Mg	0.35 (0.04)%	0.15 – 1.03%	0.04 – 1.00%
K	1.61 (0.15)%	0.32 – 3.36%	0.50 – 0.80%
Na	0.059 (0.008)%	0.025 – 0.332%	0.04 – 0.10%
Cl	0.05 (0.01)%	Trace – 0.110%	–
Si	2.27 (0.28)%	0.51 – 6.64%	–
Zn	79.28 (10.04) ppm	34 – 550 ppm	20 – 50 ppm
Fe	807.39 (105.15) ppm	210 – 3220 ppm	10 – 50 ppm
Mn	588.64 (98.51) ppm	43 – 2578 ppm	20 – 40 ppm
Cu	13.08 (3.79) ppm	Trace – 120 ppm	4 – 5 ppm
Ca/P	4.49 (1.19)	0.30 – 42.33	1 – 2

Figures in parentheses are the standard errors
* NRC (1975, 1976 and 1981) requirements.

CONCLUSION

Leaves of trees, shrubs and herbs are rich in their contents of micro- and macro-mineral elements especially Mg, K, Fe and Mn. These compositional analyses would serve as a basis for computing the supplemental mineral requirements of livestock fed these browse species.

With the constantly increasing cost of conventional animal feed ingredients, the need for the incorporation of browse leaves in animal diets has called for a greater knowledge of the chemical contents.

ACKNOWLEDGEMENT

The authors are immensely grateful to the International Institute of Tropical Agriculture, Ibadan, Nigeria for supplying the *Manihot spp.* (cassava) leaves as well as carrying out most of the mineral analyses.

We also appreciate the support of the International Livestock Centre for African and the University of Ibadan, Nigeria.

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