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THE CRUDE PROTEIN AND MINERAL COMPOSITION OF SOME TROPICAL GRASSES IN TRINIDAD

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ABSTRACT

One hundred and six grasses grown in plots 2.4m x 1.2m at the University Field Station, Valsayn, Trinidad were cut twice at six weeks of regrowth, in the rainy season. They were analysed for crude protein (CP), Ca, P, Mg, K, Na, Cu, Fe, Mn and Zn content. The ranges of CP, Ca, P, Mg, K and Na (g kg^{-1} dry matter DM) were 58-141, 2.8 - 12.6, 1-3, 0.7-4.4, 1.1-6.4 and 0-16-6.90, respectively, and for Cu, Fe, Mn and Zn (mg kg^{-1} DM) were 2.2-11.9, 90-1473, 63-983 and 11-59, respectively. The percentages of grasses having concentrations of CP, Ca, P, Mg, K and Na below (g kg^{-1} DM) 100, 3, 2, 2, 5 and 1 were 68.9, 0.9, 71.7, 41.5, 88.7 and 41.5, respectively, and the corresponding values of Cu, Fe, Mn and Zn below (mg kg^{-1} DM) 10, 100, 100 and 30 were 98.1, 0.9, 1.9 and 52.8, respectively. The results are discussed in the light of the requirements of grazing beef and dairy cattle, sheep and goats.

RESUMEN

Se cultivó ciento seis tipos de hierba en semilleros de 2,4m x 1,2m en la Estación Experimental Universitaria en Valsayn, Trinidad y se las cortó dos veces a unas seis semanas del nuevo crecimiento durante la estación lluviosa. Se las analizó para determinar su contenido de proteinas crudas (CP), Ca, P, Mg, K, Na, Cu, F, Mn y Zn. Los valores de CP, Ca, P, Mg, K y Na (g/kg de DM – materia seca) eran de 58 - 141; 2,8 - 12,6; 1 - 3; 0,7 - 4,0; 1,1 - 6,4 y 0,16 - 6,90 respectivamente. Los de Cu, Fe, Mn y Zn (mg/kg DM) eran de 2,2 - 11,9; 90 - 1473; 92 - 983 y 11 - 59, respectivamente. Los porcentajes de hierbas con concentraciones de CP, Ca, P, Mg, K y Na inferiores a 100, 3, 3, 2, 8 y 1 (g/kg DM) eran de 68,9; 0,9; 41,5; 34,9; 100 y 41,5 respectivamente. Los valores de Cu, Fe, Mn, y Zn inferiores a 10, 100, 40, y 50 (mg/kg DM) eran de 98,1; 0,9; 0,0 y 99,1 respectivamente. Se examina los resultados, teniendo en cuenta los requistos para el apacentamiento de gando vacuno, tano de engorde como lechero, así como de ovejas y cabras.

Keywords: Tropical grasses; Crude protein; Macro-minerals; Micro-minerals.

The profitability of an agricultural enterprise, whether it is crop or livestock, depends largely on the provision of the nutrient requirements for optimal productivity. To graze livestock, a knowledge of the nutrient composition of forages, i.e. energy, protein, minerals and vitamins, is clearly important for proper supplementation if the desired economical level of productivity is to be achieved.

In Trinidad and, indeed, in all the Commonwealth Caribbean countries, research on tropical forages, in the past three decades, has concentrated on energy and protein utilization (e.g. Butterworth, 1965; Butterworth and Butterworth, 1965; Grieve and Osbourn, 1965). However, information on the mineral composition of forages in the Caribbean, excepting calcium and phosphorus, is very limited (Devendra, 1977; Poland and Schnabel, 1980). Two recent studies in Trinidad have indicated varying degrees of macro- and micro-mineral deficiencies in cattle, sheep and goats; Mohammed (1981) found copper to be deficient as a result of an analysis of blood and liver of cattle and Youssef (1984), analysing blood from sheep and goats, showed possible deficiencies in Ca, P, Mg, K, Na, Cu and Zn.

This paper gives the crude protein (CP), Ca, P, Mg, K, Na, Cu, Fe, Mn, and Zn contents of 106 tropical grasses when cut at six weeks of regrowth.

Material and Methods

Grasses

One hundred and six tropical grasses (See Table 1) were established and maintained over a number of years in plots 2.4m x 1.2m on River Estate loam at the University Field Station, Valsayn, Trinidad. The plots received a top-dressing of 40 kg ha^{-1} of N as sulphate of ammonia approximately 4 weeks before they were cut. The grasses were cut twice at 6 weeks of regrowth to approximately 7 cm above the ground, using a grass knife, on 17 November and 29 December, 1983. Representative samples of the grasses were placed in polyethylene bags and at the laboratory they were given a rapid wash with tap water followed by glass-distilled water. This washing procedure was sometimes found necessary in order to remove soil contamination, particularly in the wet season.

Chemical analysis

Grasses were dried at 60°C in a forced-draught oven to a constant weight, and hammer milled in a stainless steel mill to pass through a 1 mm sieve. Total N was determined by the Kjeldahl method so that g N kg^{-1} dry matter (DM) x 6.25 gives gCP kg^{-1}DM. Ca, Mg, K, Na, Cu, Fe, Mn and Zn were determined according to Fick *et al.* (1979) using a Pye Unicam SP 2900 Atomic Absorption Spectrophotometer equipped with a PU 9090 Data Graphics System. P was determined by the method of Cavell (1955) using a Pye Unicam PU 8600 UV/ Visible Spectrophotometer. National Bureau of Standards, Washington, D.C., U.S.A., Standard Reference Materials 1571 (orchard leaves) and 1573 (tomato leaves) were used as controls for all minerals analysed. All samples were analysed in duplicate and, therefore, 4240 analyses were carried out.

Results and discussion

Table 1 shows the average CP and macro-mineral contents for each of the 106 grasses investigated, and Table 2 presents the average micro-mineral contents for each grass. It can be seen that there were variations among grasses in the concentrations of the ten nutrients studied when they were grown on the same soil and cut at the 6-week stage of regrowth. In Kenya, 58 grasses grown on a single soil type showed wide ranges of 0.9-5.5 and 0.5-3.7g kg^{-1}DM for Ca and P, respectively (Dougall and Bogdon, 1958). The corresponding ranges in the present study were 2.2-12.6 and 1.0-3.0 g kg^{-1} DM.

Table 1 The crude protein and macro-mineral content (g/kg dry matter) of some tropical grasses

Botanical name	Common name	Crude Protein	Ca	P	Mg	K	Na
Acroceras macrum	Nyle grass	138	4.1	1.5	2.0	2.1	6.90
Andropogon gayanus (SR. 593) G. Coast	Gamba grass	64	4.5	1.1	1.9	2.6	0.16
Bothriochloa intermedia (SR. 955) U.S.D.A.		78	5.3	1.1	1.5	1.7	0.76
Brachiaria brizantha	Ceylon Sheep grass	86	8.4	1.6	1.7	3.6	1.09
Brachiaria decumbens	Kenya Sheep grass	86	7.6	1.7	2.2	4.1	1.24
Brachiaria dictyoneura	Sheep grass	88	5.8	1.9	1.4	3.1	3.15
Brachiaria platyphylla	Wild Para grass	81	4.5	1.5	3.3	5.0	1.25
Brachiaria ruziziensis (SR.879) Kenya		91	7.2	1.7	1.6	2.2	1.42
Brachiaria sp (SR. 1237 -2) U.S.D.A		103	4.8	2.1	1.8	3.8	4.02
Brachiaria subquadripara	Lawn Brachiaria	96	5.3	1.5	1.5	3.6	3.15
Chloris gayana (SR.1011) Kenya	Masaba Rhodes grass	66	6.6	1.0	3.6	2.1	0.20
Chloris gayana (SR.1012) Kenya	Mpwapwa Rhodes grass	91	6.9	1.5	3.7	2.1	0.83
Chloris gayana (SR.1013) Kenya	Mbarara Rhodes grass	86	6.2	2.1	1.4	5.5	4.01
Chloris gayana (SR.1036) S. Rhodesia	Katambora Rhodes grass	128	6.6	1.7	2.9	6.4	0.48
Cenchrus ciliaris	Buffel grass	119	3.3	1.5	1.5	2.6	5.50
Cenchrus ciliaris (SR.942) U.S.D.A.		86	4.3	1.5	1.7	2.3	4.14
Cymbopogon citratus	Lemon grass	108	10.5	1.5	2.1	3.0	0.27
Cymbopogon nardus	Citronella grass	120	6.3	1.2	1.5	1.7	0.48
Cynodon dactylon	Bermuda or Bahamas grass	116	8.2	2.6	2.6	3.8	6.79
Cynodon dactylon (SR.615) Tanganyika	Star grass	129	6.6	1.8	2.2	2.2	5.64
Cynodon dactylon (SR.792) Florida	Coastal Bermuda grass	138	7.6	1.8	2.3	1.8	4.77
Cynodon dactylon (SR.948) Kenya	Giant type Star grass	136	7.0	1.6	2.2	2.0	4.28
Cynodon dactylon (SR.952) Kenya	Medium type Star grass	139	6.5	1.7	2.4	2.1	4.03
Cynodon dactylon (SR.954) Kenya	Fine type Star grass	116	5.3	1.5	2.0	2.0	4.56
Cynodon dactylon (SR.999) Puerto-Rico	Tifgreen Bermuda grass	121	8.3	2.3	3.0	2.4	3.32
Cynodon plectostachyus (SR.955) Tanganyika	Naivasha Star grass	121	6.0	1.7	1.9	2.4	4.74
Digitaria chevalieri (SR.1242-1) U.S.D.A		85	5.3	2.0	1.5	2.6	3.85
Digitaria decumbens (SR.633) Surinam	Pangola	77	6.6	1.5	1.7	2.2	3.43
Digitaria decumbens ch.27 (SR.974) St. Croix	Pangola	101	6.5	1.7	1.7	2.1	3.55
Digitaria decumbens ch.30 (SR.975) St. Croix	Pangola	96	5.1	1.5	1.6	1.5	3.48
Digitaria decumbens (SR.1028) Taiwan	Pangola A.24	77	6.5	1.7	2.0	2.5	3.46
Digitaria decumbens (SR.1228-5) U.S.D.A	Pangola selection	95	4.6	1.6	1.6	1.4	3.01
Digitaria decumbens (SR.1228-6) U.S.D.A	Pangola selection	81	5.8	1.7	1.8	2.1	3.67
Digitaria decumbens (SR.1228-7) U.S.D.A	Pangola selection	81	5.1	1.8	1.7	2.6	4.68
Digitaria decumbens (SR.1228-13) U.S.D.A	Pangola selection	89	4.7	1.6	1.6	1.7	3.68
Digitaria eriantha (SR.1229-5) U.S.D.A		79	4.9	1.7	2.8	3.3	2.91
Digitaria grazensis (SR.1248-2) U.S.D.A		98	5.0	1.8	2.6	1.9	2.85
Digitaria longiflora (SR.1232-1) U.S.D.A		83	4.8	2.4	1.3	3.3	3.14
Digitaria macroglossa (SR.1236-1) U.S.D.A		118	4.3	1.5	1.6	2.3	3.73
Digitaria milanjiana (SR.1225-4) U.S.D.A		127	6.5	2.1	4.2	4.9	0.53
Digitaria milanjiana (SR.1225-8) U.S.D.A		109	7.2	2.0	4.0	4.3	0.64
Digitaria milanjiana var *eyesiana* (SR.1226-4) U.S.D.A		98	5.6	1.8	3.4	2.7	0.65

Table 1 continued

Botanical name	Common name	Crude Protein	Ca	P	Mg	K	Na
Digitaria milanjiana var *eyesiana* (SR.1226-7) U.S.D.A		84	7.1	2.0	3.9	2.7	0.95
Digitaria pentsii (SR.908/1) Pretoria		96	6.0	1.8	2.5	2.0	2.18
Digitaria pentsii (SR.989) Pretoria		93	5.9	1.7	3.5	2.1	1.13
Digitaria pentsii (SR.1231-2) U.S.D.A		99	6.6	2.0	2.8	2.5	1.98
Digitaria pentsii (SR.1231-10) U.S.D.A		111	4.6	1.5	1.7	2.3	3.38
Digitaria polevansii (SR.1234-1) U.S.D.A		68	3.3	1.2	1.4	2.8	5.90
Digitaria scalarum (SR.1243-1) U.S.D.A		86	4.6	1.7	1.7	2.2	3.37
Digitaria setivalva (SR.1227-2) U.S.D.A		81	5.1	1.7	1.4	2.2	3.84
Digitaria setivalva (SR.1227-5) U.S.D.A		72	4.5	1.3	1.3	2.5	3.34
Digitaria smutsii (SR.903/3) Pretoria		133	7.9	1.8	4.4	1.1	2.00
Digitaria smutsii (SR.934) Guncon S.A.		118	5.8	1.6	4.0	2.4	1.88
Digitaria smutsii (SR.1224-1) U.S.D.A		111	7.1	1.7	4.4	3.0	3.99
Digitaria sp ((296210) SR.1253-1) U.S.D.A		91	5.1	2.1	1.7	2.4	4.91
Digitaria swazilandensis (SR.1233-1) U.S.D.A		96	5.0	2.1	1.4	2.1	3.23
Digitaria valida (SR.976) St.Croix		97	5.3	1.8	1.9	5.1	4.36
Digitaria valida (SR.983) Pretoria		83	6.1	2.1	1.9	3.5	3.34
Digitaria valida (SR.1230-8) U.S.D.A.		86	5.1	1.9	1.8	2.3	2.63
Digitaria valida (SR.1230-15) U.S.D.A.		74	6.9	2.0	1.9	2.6	4.03
Digitaria valida (SR.1230-16) U.S.D.A.		81	7.9	2.1	2.3	3.0	5.08
Echinochloa pyramidalis (SR.602) Pretoria		95	6.4	1.6	1.9	3.7	5.67
Echinochloa pyramidalis (SR.847) Uganda		93	7.1	1.8	2.9	4.4	4.24
Eriochloa polystachya	Malojilla grass	129	5.0	1.7	2.7	4.7	5.82
Eragrostis curvula (SR.935) Gunson	Weeping Love grass (Am. leafy)	76	3.1	1.1	0.9	2.4	0.33
Eragrostis curvula (SR.951A) Pretoria	Weeping Love grass (wide leaf sel.)	64	2.8	1.4	0.7	2.4	1.94
Hemarthria altissima (SR.1238 -a) U.S.D.A.		58	3.9	1.5	1.1	2.7	0.64
Hyparrhenia rufa	Jaragua grass	82	7.7	1.5	2.5	1.9	0.21
Ischaemum aristatum	Toco grass	99	6.9	2.0	1.9	2.8	4.67
Ischaemum aristatum Fiji	Batiki grass	86	7.0	1.5	3.6	3.0	0.33
Ixophorus unisetus	Mexican grass	74	7.4	1.9	2.9	3.0	0.26
Leptocoryphium lanatum		108	3.7	1.4	2.5	4.2	0.36
Melinis minutiflora	Molasses grass	98	3.9	1.9	2.3	4.1	0.18
Panicum antidotale		101	12.6	2.3	3.9	2.1	1.10
Panicum coloratum (SR.899) Kenya	Coloured Guinea grass	69	6.5	1.1	1.9	2.0	3.06
Panicum maximum	Colonial Guinea grass	96	9.0	1.5	3.8	2.2	0.58
Panicum maximum (SR.890) Jamaica	Cow Guinea grass	95	9.8	1.7	3.9	2.3	0.40
Panicum maximum (SR.891) Jamaica	Silk Guinea grass	97	9.2	1.3	3.5	2.0	0.58
Panicum purpurascens		107	5.4	1.5	1.9	4.5	6.07
Panicum maximum var. *trichoglume* (SR.892) Kenya	Slender Guinea grass	78	9.6	1.5	2.9	2.1	0.76
Paspalum commersonii (SR.1041) Australia		81	5.0	2.3	2.1	4.7	0.23
Paspalum dilatatum	Dallis grass	81	4.8	2.3	2.6	4.4	0.16
Paspalum notatum	Bahia grass	99	6.9	2.1	1.8	4.6	0.30
Paspalum notatum (SR.926) U.S.D.A.	Argentina grass	110	6.5	2.4	2.1	5.0	0.34
Paspalum notatum (SR.927) Maryland	Tifhi	111	5.4	2.5	2.1	5.0	0.26
Paspalum notatum (SR.928)	Wilmington	109	7.4	2.4	2.3	4.2	0.34
Paspalum paniculatum		94	9.2	3.0	3.2	5.8	0.45
Paspalum plicatulum	Crown Land grass	81	9.1	2.3	2.7	5.3	0.41

Table 1 continued

Botanical name	Common name	Crude Protein	Ca	P	Mg	K	Na
Paspalum plicatulum (SR. 851) Australia	Crown Land grass	83	8.0	2.2	3.0	5.3	0.30
Paspalum ragassi (SR.1038) S. Rhodesia		84	4.7	2.2	2.1	4.2	0.38
Paspalum urvillei (Sr,981) B.G	Vasey grass	81	7.1	1.8	1.6	5.5	0.49
Paspalum vaginatum	Sand Couch grass	79	6.8	2.1	2.4	6.3	0.36
Paspalum virgatum	Razor grass	83	4.8	2.3	2.2	4.9	0.34
Pennisetum polystachyon	Kyasuwa grass	81	7.8	1.6	3.8	2.3	0.33
Pennisetum purpureum var *merkeri*	Merker grass	87	7.9	1.7	3.4	3.0	0.16
Pennisetum purpureum	Uganda grass	100	8.2	1.6	3.0	2.4	0.20
Pennisetum setosum		94	4.8	1.5	2.2	2.4	3.83
Rottboellia exaltata	Corn grass	76	6.2	2.8	2.9	2.6	0.39
Saccharum ciliare	Montserrat	78	3.6	1.3	1.5	3.9	0.19
Setaria anceps (SR.856) S. Rhodesia	Golden Timothy (Kazungula)	88	4.8	1.6	2.0	3.4	3.96
Setaria anceps (SR.1006) Kenya	Golden Timothy (Nandi)	106	4.9	1.5	2.1	3.3	3.51
Sporobolus indicus	Tapia grass	79	4.1	1.6	1.5	2.2	2.07
Themeda triandra (SR.911) Pretoria		69	7.0	1.7	2.8	3.0	0.30
Tripsacum latiflora		141	3.8	1.8	2.5	3.9	0.32
Tripsacum laxum	Guatemala	134	3.2	1.3	2.2	2.6	0.26
Vetiveria zizanoides	Khus Khus grass	88	4.4	1.3	2.5	5.6	0.32

Table 2 The trace mineral content (mg/kg dry matter) of some tropical grasses

Botanical name	Common name	Cu	Fe	Mn	Zn
Acroceras macrum	Nyle grass	11.9	1333	360	59
Andropogon gayanus (SR. 593) G. Coast	Gamba grass	2.2	263	300	34
Bothriochloa intermedia (SR. 955) U.S.D.A.		3.2	630	408	23
Brachiaria brizantha	Ceylon Sheep grass	2.7	450	534	34
Brachiaria decumbens	Kenya Sheep grass	3.5	444	389	35
Brachiaria dictyoneura	Sheep grass	3.4	657	828	33
Brachiaria platyphylla	Wild Para grass	4.6	503	114	24
Brachiaria ruziziensis (SR.879) Kenya		2.9	477	812	36
Brachiaria sp (SR. 1237 -2) U.S.D.A		3.6	670	629	34
Brachiaria subquadripara	Lawn Brachiaria	3.2	548	501	27
Chloris gayana (SR.1011) Kenya	Masaba Rhodes grass	2.7	142	166	27
Chloris gayana (SR.1012) Kenya	Mpwapwa Rhodes grass	4.8	377	155	18
Chloris gayana (SR.1013) Kenya	Mbarara Rhodes grass	3.1	204	355	26
Chloris gayana (SR.1036) S. Rhodesia	Katambora Rhodes grass	6.0	246	145	23
Cenchrus ciliaris	Buffel grass	4.7	487	533	38
Cenchrus ciliaris (SR.942) U.S.D.A.		3.7	350	576	30
Cymbopogon citratus	Lemon grass	4.8	279	359	31
Cymbopogon nardus	Citronella grass	5.1	281	471	20
Cynodon dactylon	Bermuda or Bahamas grass	7.6	531	425	53
Cynodon dactylon (SR.615) Tanganyika	Star grass	7.3	688	308	40
Cynodon dactylon (SR.792) Florida	Coastal Bermuda grass	8.3	1084	416	38

Table 2 continued

Botanical name	Common name	Cu	Fe	Mn	Zn
Cynodon dactylon (SR.948) Kenya	Giant type Star grass	8.2	879	255	38
Cynodon dactylon (SR.952) Kenya	Medium type Star grass	8.6	1157	255	38
Cynodon dactylon (SR.954) Kenya	Fine type Star grass	6.2	536	270	35
Cynodon dactylon (SR.999) Puerto-Rico	Tifgreen Bermuda grass	7.1	490	278	40
Cynodon plectostachyus (SR.955) Tanganyika	Naivasha Star grass	5.4	522	374	32
Digitaria chevalieri (SR.1242-1) U.S.D.A		5.2	658	564	33
Digitaria decumbens (SR.633) Surinam	Pangola	5.2	488	409	37
Digitaria decumbens ch.27 (SR.974) St. Croix	Pangola	5.8	665	475	38
Digitaria decumbens ch.30 (SR.975) St. Croix	Pangola	5.7	572	428	38
Digitaria decumbens (SR.1028) Taiwan	Pangola A.24	5.2	499	445	38
Digitaria decumbens (SR.1228-5) U.S.D.A	Pangola selection	4.8	399	394	35
Digitaria decumbens (SR.1228-6) U.S.D.A	Pangola selection	5.0	508	410	34
Digitaria decumbens (SR.1228-7) U.S.D.A	Pangola selection	4.3	404	309	32
Digitaria decumbens (SR.1228-13) U.S.D.A	Pangola selection	5.3	290	337	34
Digitaria eriantha (SR.1229-5) U.S.D.A		5.1	618	266	22
Digitaria grazensis (SR.1248-2) U.S.D.A		5.4	870	387	27
Digitaria longiflora (SR.1232-1) U.S.D.A		3.1	520	335	26
Digitaria macroglossa (SR.1236-1) U.S.D.A		6.3	599	361	30
Digitaria milanjiana (SR.1225-4) U.S.D.A		6.0	513	336	24
Digitaria milanjiana (SR.1225-8) U.S.D.A		6.9	983	539	31
Digitaria milanjiana var *eyesiana* (SR.1226-4) U.S.D.A		4.9	635	318	22
Digitaria milanjiana var *eyesiana* (SR.1226-7) U.S.D.A		5.6	1162	579	25
Digitaria pentsii (SR.908/1) Pretoria		6.7	733	443	24
Digitaria pentsii (SR.989) Pretoria		5.3	756	423	31
Digitaria pentsii (SR.1231-2) U.S.D.A		6.4	1473	412	34
Digitaria pentsii (SR.1231-10) U.S.D.A		5.5	627	347	33
Digitaria polevansii (SR.1234-1) U.S.D.A		9.9	627	347	35
Digitaria scalarum (SR.1243-1) U.S.D.A		4.3	551	424	25
Digitaria setivalva (SR.1227-2) U.S.D.A		4.5	656	348	26
Digitaria setivalva (SR.1227-5) U.S.D.A		2.6	611	284	12
Digitaria smutsii (SR.903/3) Pretoria		11.2	875	329	41
Digitaria smutsii (SR.934) Guncon S.A.		7.9	750	396	33
Digitaria smutsii (SR.1224-1) U.S.D.A		8.0	1465	390	29
Digitaria sp ((296210) SR.1253-1) U.S.D.A		4.3	429	298	29
Digitaria swazilandensis (SR.1233-1) U.S.D.A		5.1	430	490	26
Digitaria valida (SR.976) St.Croix		4.7	587	470	35
Digitaria valida (SR.983) Pretoria		4.8	554	445	34
Digitaria valida (SR.1230-8) U.S.D.A.		5.3	267	379	43
Digitaria valida (SR.1230-15) U.S.D.A.		4.3	635	437	24
Digitaria valida (SR.1230-16) U.S.D.A.		4.6	570	314	25
Echinochloa pyramidalis (SR.602) Pretoria		5.8	314	379	20
Echinochloa pyramidalis (SR.847) Uganda		6.2	297	282	22
Eriochloa polystachya	Malojilla grass	8.4	557	145	39
Eragrostis curvula (SR.935) Gunson	Weeping Love grass (Am. leafy)	2.9	288	193	16
Eragrostis curvula (SR.951A) Pretoria	Weeping Love grass (wide leaf sel.)	2.4	158	115	11
Hemarthria altissima (SR.1238 -a) U.S.D.A.		3.9	266	214	25
Hyparrhenia rufa	Jaragua grass	3.5	476	481	29
Ischaemum aristatum	Toco grass	4.2	90	347	18

Table 2 continued

Botanical name	Common name	Cu	Fe	Mn	Zn
Ischaemum aristatum Fiji	Batiki Grass	4.1	102	207	29
Ixophorus unisetus	Mexican grass	3.0	346	269	33
Leptocoryphium lanatum		4.3	392	253	28
Melinis minutiflora	Molasses grass	3.2	190	837	18
Panicum antidotale		5.5	271	153	20
Panicum coloratum (SR.899) Kenya	Coloured Guinea grass	5.4	270	194	25
Panicum maximum	Colonial Guinea grass	4.7	409	418	24
Panicum maximum (SR.890) Jamaica	Cow Guinea grass	4.6	440	393	30
Panicum maximum (SR.891) Jamaica	Silk Guinea grass	5.0	520	444	28
Panicum purpurascens		9.5	338	118	34
Panicum maximum var. *trichoglume* (SR.892) Kenya	Slender Guinea grass	4.3	404	374	25
Paspalum commersonii (SR.1041) Australia		4.6	271	197	14
Paspalum dilatatum	Dallis grass	5.4	300	229	16
Paspalum notatum	Bahia grass	5.6	648	287	27
Paspalum notatum (SR.926) U.S.D.A.	Argentina grass	5.5	564	194	29
Paspalum notatum (SR.927) Maryland	Tifhi	6.0	601	130	31
Paspalum notatum (SR.928)	Wilmington	6.0	974	292	21
Paspalum paniculatum		8.9	702	115	24
Paspalum plicatulum	Crown land grass	6.1	668	879	33
Paspalum plicatulum (SR. 851) Australia	Crown land grass	6.4	805	983	36
Paspalum ragassi (SR.1038) S. Rhodesia		4.9	321	171	14
Paspalum urvillei (Sr,981) B.G	Vasey grass	5.2	447	267	20
Paspalum vaginatum	Sand couch grass	4.9	466	204	22
Paspalum virgatum	Razor grass	4.6	272	161	15
Pennisetum polystachyon	Kyasuwa grass	3.7	310	437	32
Pennisetum purpureum var *merkeri*	Merker grass	3.7	316	340	29
Pennisetum purpureum	Uganda grass	4.3	418	354	29
Pennisetum setosum		4.0	252	514	35
Rottboellia exaltata	Corn grass	4.2	442	63	30
Saccharum ciliare	Montserrat	4.2	135	92	14
Setaria anceps (SR.856) S. Rhodesia	Golden Timothy (Kazungula)	5.7	373	408	45
Setaria anceps (SR.1006) Kenya	Golden Timothy (Nandi)	6.1	117	287	44
Sporobolus indicus	Tapia grass	2.9	332	778	24
Themeda triandra (SR.911) Pretoria		2.9	248	149	23
Tripsacum latiflora		4.7	205	211	25
Tripsacum laxum	Guatemala	4.0	190	136	18
Vetiveria zizanoides	Khus Khus grass	4.8	137	279	12

Devendra (1977) reported Ca, P and Mg concentrations of 101 grasses of unknown age of regrowth collected mainly from Trinidad; the Ca levels were clearly lower and those of Mg were very much higher than the respective levels reported in the present study. Also P values were higher than those presently reported. The high levels of 5-8g kg^{-1}DM in the majority of the grasses reported by Devendra (1977) could not be confirmed from the analysis of more than 2,000 grass samples collected from Trinidad (F. G. Youssef, unpublished data).

The concentration of K in most of the grasses studied was low when compared with other values reported for tropical grasses (Long *et al.*, 1969; Poland and Schnabel, 1980). As the level of P was also low in most of the grasses, there is a possibility that the application of P and K fertilizers would raise their P and K levels. The values of Na varied greatly with a range of 0.16-6.90 g kg^{-1}DM. Griffith and Walters (1966) indicated that the level of Na in grasses can establish differences between species more than any other constituent.

In the Caribbean there is very little information on the trace mineral content of forages. In the present study the Cu and Zn levels were lower, and those of Fe and Mn higher than the corresponding values of Latin American forages (McDowell *et al.*, 1977). In Jamaica, Poland and Schnabel (1980) found that the ranges for Cu, Fe, Mn and Zn were 2.9-8.4, 98-144, 41-344 and 25-125 mg kg^{-1}DM, respectively, in *Digitaria decumbens and Brachiaria decumbens.*

Crude protein

The CP values of the grasses confirm earlier results from this University (Grieve and Osbourn, 1965). The range was 58-141 g CP kg^{-1} DM. The level of 100g CP kg^{-1}DM would satisfy the maintenance requirements of beef and dairy cattle, and sheep and goats, and produce some beef, milk and mutton respectively. Sixty-nine per cent of the grasses had CP concentrations below 100g kg^{-1} DM and for 19 per cent it was below 80g kg^{-1} DM.

Calcium

The range of the Ca content was 2.8 – 12.6 g kg^{-1} DM, and only *Eragrostis curvula* (SR. 950A) had a concentration below 3g Ca kg^{-1}. The ranges for the requirements of beef cattle, dairy cattle and sheep are 1.8 - 5.3, 4.3 - 6.0 and 2.1 - 5.2 g kg^{-1}DM, respectively (National Research Council, 1984; 1978; 1975). It is clear that the Ca content of most of the grasses would satisfy the requirements of these three classes of livestock.

Phosphorus

P values ranged from 1 to 3g kg^{-1}DM, and the percentage of grasses having a level below 2g P kg^{-1} was 71.7. The P requirements of beef and dairy cattle and sheep are 1.8-4.7, 3.1 - 4.0 and 1.6 - 3.7g kg^{-1}DM, respectively (National Research Council, 1984; 1978; 1975). Thus P content of 75 percent of the grasses would at least provide the maintenance requirements of the three classes of ruminants.

Magnesium

The range for Mg was 0.7 - 4.4g kg^{-1}DM, and the percentage of grasses having concentration below 2g Mg kg^{-1} was 41.5. The beef and dairy cattle and sheep requirements of Mg are 0.5 - 2.5, 2 and 0.4 - 0.8g kg^{-1}DM, respectively (National Research Council 1984; 1978; 1975). Therefore, the Mg content of the majority of the grasses would satisfy the requirements of beef and dairy cattle and sheep.

Potassium

The K level in the majority of the grasses was low with a range of 1.1 - 6.4g kg^{-1}DM. The percentage of grasses which contained below 5g K kg^{-1}DM was 88.7. The K requirements of beef and dairy cattle and sheep are 5-7, 8-12 and 5g kg^{-1} DM, respectively (National Research Council 1984, 1978, 1975). Clearly the majority of the grasses would not satisfy the requirements of these animals.

Sodium

The concentration of Na in the grasses varied from 0.16 to 6.90g kg^{-1}DM. The percentage of grasses with a level below 1g Na kg^{-1} was 41.5. The beef and dairy cattle and sheep requirements of Na are 0.6 - 1.0, 1.8 and 0.4 - 1.0g kg^{-1}DM, respectively (National Research Council 1984; 1978; 1975). Approximately 51 percent of the grasses would provide the dairy cattle requirement of Na, whilst, about 75 percent would satisfy the beef cattle and sheep in this respect.

Copper

The range of Cu in the grasses was 2.2 -11.9mg kg^{-1}DM, and the percentage of grasses with a concentration below 10mg Cu kg^{-1} was 98. The Cu requirements of beef and dairy cattle and sheep are 4-10, 10 and 5 mg kg^{-1}DM, respectively (National Research Council, 1984; 1978; 1975). Accepting the requirement of beef cattle to be 8mg Cu kg^{-1} DM (McDowell *et al.*, 1983), approximately 9 percent of the grasses would be satisfactory. In the case of dairy cattle all the grasses except *Acroceras macrum, Digitaria smutsii* (SR. 903/3) and *Panicum purpurascens* would be considered deficient in Cu. As for sheep, 49 percent of the grasses would provide their Cu reqirements.

Iron

The concentration of Fe in the grasses ranged from 90 to 1473mg kg^{-1}DM, and only *Ischaemum aristatum* grass had a level below 100 mg kg^{-1} . As the requirement for Fe of ruminant livestock is below 100mg kg^{-1}DM, all the grasses are considered adequate. The maximum tolerable levels of dietary Fe are 1000mg kg^{-1} for cattle and possibly 500mg kg^{-1} for sheep (National Research Council, 1980). The high Fe content of some of the grasses would be detrimental to cattle and sheep. Indeed, the very high levels of Fe might interfere with Cu metabolism.

Manganese

The range of Mn found in the grasses was 63-983mg kg^{-1}DM, and only *Rottboellia exaltata* and *Saccharum ciliare* had levels below 100mg kg^{-1}. All had adequate levels of Mn for ruminants.

Zinc

The level of Zn in the grasses studied varied from 11 to 59mg kg^{-1}DM. The percentage of grasses with a concentration below 30mg kg^{-1} was 53. The Zn requirements of beef and dairy cattle and sheep are 20-40, 40 and 35-50mg kg^{-1}DM, respectively (National Research Council, 1984, 1978, 1975). If the Zn requirement of beef cattle is taken as 30 mg kg^{-1} DM (McDowell *et al.*, 1983), 48 percent of the grasses would provide their requirement. However, only about 20 percent of the grasses would satisfy the requirement of dairy cattle and sheep.

Conclusion

Variations existed among the grasses in the concentrations of the ten nutrients studied. Values of P, Mg, and K were generally lower and those of Ca higher than those previously reported, Levels of trace elements Cu and Zn were lower and those of Fe and Mn higher than the values cited in the literature. The data reported are a useful guide for the proper supplementation of forages to desired and economic levels of productivity in different species of livestock. The effects of fertilizer, stage of regrowth and date of harvesting on the mineral profile of some of the grass species are currently under study.

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