NUTRITIONAL COMPOSITION OF LATIN AMERICAN FORAGES[1]

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The Latin American Tables of Feed Composition published in 1974 contained data on 3,390 feeds. Of this tote], 85% were different from those of the US and Canada. Approximately 77% (2615) of the entries were forages. Of the forage entries, 74% included values for the complete proximate analysis and approximately 43% included both calcium and phosphorus values. Data on only a small percentage of the forage entries included mineral concentrations and forage evaluation methods. Approximately 25% of both the Latin American and US-Canadian forages contained 7% crude protein or less. Latin American forages tended to have higher ash and crude fibre but lower nitrogen-free extract than US-Canadian forages. Of the forages, almost 75% of the phosphorus and 31% of the calcium entries were 0.3% or less,- which may be borderline to deficient in these elements. Borderline or deficient levels of certain elements were reported for many entries: Co 43%, Cu 47%, Mg 35%, Na 60% and Zn 75%. Wide scale deficiencies of iron, manganese, and potassium or toxicities of molybdenum are not to be expected.

Key words: Forages, Latin America, minerals, nutrients.

In 1969, a University of Florida- Agency for International Development project was initiated to gather feed composition data from Latin American and Caribbean countries. At project termination in 1974, "Latin American Tables of Feed Composition" (McDowell et al 1974) were published in English, Spanish and Portuguese. The present report summarizes and evaluates information concerning 2615 forages entered in this publication.

Materials and Methods

Standardized source form books listing nutrients served as the vehicle for obtaining data from Latin American and Caribbean countries. Methods of data collection and computer summarization procedures have been reported previously (Harris et al 1967; Harris et al 1968, Christian sen et al 1973).

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The 1974 edition of Latin American Tables of Feed Composition (McDowell et al 1974) was composed of data on 3,390 feed entries (2,615 forages)with unique names. Over 35,000 source forms were contributed by 69 laboratories in 21 Latin American and Caribbean countries. Because only 182 of the 3,390 entries contained digestible protein and/or energy values, prediction equations were used to calculate additional values (McDowell et al 1974). The extreme shortage of digestibility studies on tropical herbage has been noted previously (Hardison 1966).

Results and Discussion

The analytical distribution of the 2615 forages entries is presented in Table 1. Seventy-four percent of the forage entries included the complete proximate analysis, while 97% included crude protein values. Only a small percentage of the forage entries had data on other forage evaluation methods, and it is disconcerting that Butterworth and Diaz (1970) and Moore and Mott (1973) indicate that the components of the proximate analysis are unsatisfactory for prediction of tropical forage quality.

With the exception of calcium and phosphorus, the vast majority of forage entries lacked both mineral and vitamin analyses. An additional major limitation of the Latin American forage data is the large number of entries (49%) for which there was only one sample (Table 2). Less than 25% of the forage analytical entries were based on the average of five or more samples.

Table 3 compares distributions of proximate analysis components between Latin American (McDowell et al 1974) and US-Canadian (National Academy of Science 1971) forages. Approximately 7% crude protein is the minimum level required for positive nitrogen-balance in mature grazing animals (Milford end Haydock 1965; Minson and Milford 1967), and 25% of both the Latin American and US-Canadian forage entries contained 7% crude protein or less. Latin American forages tended to have higher ash and crude fibre but lower nitrogen-free extract than US-Canadian forages. Crude fibre content of greases commonly constitutes some 30 to 36% of the dry matter in Caribbean (Devendra and Gohl 1970) and Nigerian (Oyenuga 1957) grasses. A much higher proportion of US-Canadian forages contained over 45% nitrogen-free extract than Latin American forages (62.5 and 46%, respectively).

Average mineral concentrations for the Latin American forage entries are presented in Table 4. With these forages, 73% of the phosphorus and 31% of the calcium values were 0.3% or less, which may be borderline to deficient in these elements for many classes of cattle. Calcium deficiency is rare in grazing cattle with the exception of cows producing large quantities of milk or those on acid, sandy or organic soil in humid areas where the herbage consists mainly of quick-growing grasses and is devoid of legume species (Underwood 1966). While calcium deficiency can easily be produced in young growing animals and lactating dairy cows fed native forages supplemented with concentrates, the deficiency has not been reported in grazing beef cattle even during lactation (Loosli and Guedes 1976). For grazing cattle, the most prevalent mineral element deficiency throughout the world is lack of phosphorus, with at least 21 Latin American and Caribbean countries reporting a deficiency (McDowell 1976; Fick et al 1976).

Table 1:
Percentage of Latin American forages (2615) analyzed for various nutrients

Nutrient or analysis	Percentage of Entries
Proximate analysis	
Complete proximate analysis	74.0
Ash	81.7
Crude fiber	76.6
Ether extract	75.9
Crude protein	97.2
Forage Evaluation Methods	
Acid detergent fiber	6.4
Cell contents	1.2
Cell walls	6.4
Cellulose	8.2
Hemicellulose	4.3
In vitro dry matter digestibility	3.5
Lignin	6.8
Minerals	
Calcium	42.9
Cobalt	5.4
Copper	9.0
Iron	9.8
Magnesium	11.1
Manganese	11.2
Molybdenum	5.1
Phosphorus	43.2
Potassium	7.6
Sodium	5.6
Zinc	6.8
Other minerals	<1.0
Vitamins	
Vitamin A equivalent	5.1
Other vitamins	<1.5

Table 2 Replication of samples for Latin American forages[a]

	No of entries	% of entries
One sample only	1289	49. 3
Averages based on 2 samples	371	14.2
Averages based on 3 samples	188	7.2
Averages based on 4 samples	143	5.4
Averages based on 5 more samples	624	23.9
Total	2615	100.0

[a]Based on the nutrient with the maximum sample number

Table 3: Proximate analysis comparisons between Latin American and United States-Canadian forages (DM basis) showing frequency distribution of means (%)

	Latin- America [1]	US-Canada[2]
Crude Protein		
No of entries	1993	1729
Percent in DM	Frequency, %	
0 - 7	24.7	24.9
7 - 10	23.9	21.3
10 - 15	22.4	21.7
15	29	32.1
Ether extract		
No of entries	1348	1523
Percent in DM	Frequency, %	
0 - 3	75.7	64.0
3 - 5	17.0	26.2
5 - 7	5.0	6.5
7	2.4	3.3
Crude fibre		
No of entries	1450	1652
Percent in DM	Frequency, %	
0 - 20	9.7	20.0
20 - 30	36.1	39.4
30 - 40	46.8	37.2
40	7.4	3.5
Ash		
No of entries	1564	1685
Percent in DM	Frequency, %	
0 - 5	5.4	5.9
5 - 10	41.9	52.2
10 - 15	43.2	29.0
15	9.5	11.8
NFE		
No of entries	1409	1619
Percent in DM	Frequency, %	
0 - 35	9.9	3.2
35 - 45	44.1	34.3
45 - 55	37.8	51.6
55	8.3	10.9

[1]McDowell, Conrad, Thomas and Harris (1974)
[2]National Academy of Sciences (1971)

Table 4a.
Average mineral concentrations of Latin American Forages

Element	Requirement[1] (% of DM)	Analysis	
		In forage (% of DM	Distribution frequency (%)
Calcium			
(n=1128)	0.18-0.60	< 0.20	16
		0.21 - 0.30	15
		0.31 - 0.49	27
		> 0.50	42
Phosphorus			
(n=1129)	0.18-0.43	< 0.10	14
		0.11-0.20	34
		0.21 - 0.30	27
		> 0.30	
Magnesium			
(n =290)	0.04 -0.18	<0.04	1
		0.05 - 0.20	34
		0.21 - 0.40	44
		> 0.40	21
Sodium			
(n = 146)	0.1	<0.05	18
		0.06 - 0.10	42
		0.11 - 0.20	18
		>0.20	22
Potassium			
(n =198)	0.06 - 0.8	<0.60	13
		0.61 - 0.80	3
		0.81 - 2.00	53
		> 2.00	32

[1] Approximate requirement according to NRC (1971, 1976) and ARC (1965)

Approximately 43% of 140 Latin American forage entries were either deficient or borderline to deficient (<0.1 mg/kg) in cobalt. Copper was deficient or borderline to deficient (< 10 mg/kg) in 47% of 236 entries, with one-half of these entries 4 mg/kg or less. Cobalt and copper deficiencies have been reported under natural grazing conditions in many countries of the world (Ammernan 1970; McDowell 1976, Fick et al 1976).

Approximately 60% of 146 entries contained mean sodium values of 0.1% or less. Forages low in sodium have been reported in numerous countries throughout the world. It has been suggested (Dirven 1963; Underwood 1966) that under tropical conditions the sodium requirement may be higher due to greater losses of sodium and water in sweat.

Grass tetany is most likely to occur when pastures contain less than 0.2% magnesium (Underwood 1966). About 35% of 290 entries contained 0.2% magnesium or less.

Naturally-occurring zinc deficiencies of grazing animals are rare, the only confirmed Latin American report being from Guyana, where cattle consumed forage containing 18 to 42 mg/kg zinc (Leng and Sears 1960). Almost 75% of the Latin American zinc entries had 50 mg/kg or less, while 49% had 30 mg/kg or less. On the basis of a zinc requirement by cattle of 10 to 50 mg/kg, future reports of deficiencies of this mineral might be expected. Other mineral elements likely to be associated with either deficiency and/or toxicity include iodine, selenium, sulphur, and fluorine. No forage analyses of fluorine or iodine were received, and only two for selenium and for sulphur. Wide-scale deficiencies of iron, manganese, and potassium, or toxicities of molybdenum are not to be expected.

Table 4b:
Average mineral concentrations of Latin American Forages

		Analysis	
Element	Requirement[1] (mg/kg)	In forage (mg/kg)	Distribution frequency (%)
Cobalt		<0.05	18
(N=140)	0.05-0.10	0.06-0.10	25
		0.11-0.20	24
		>0.20	33
Copper		4	23
(N=236)	4-10	5-20	24
		11-50	48
		>50	5
Iron			
(n=256)	10-100	<30	4
		31-100	21
		101-500	54
		>500	21
Manganese			
(n=293)	20-40	<20	5
		21-40	16
		41-100	37
		>101	42
Molybdenum			
(n=133)	0.01	<0.06	5
		0.06-3.0	82
		3.1-6.0	8
		>6.0	5
Zinc			
(n=177)	10-50	<30	49
		31-50	25
		51-75	19
		>75	7

1 Approximate requirement according to the NRC (1971, 1976) and ARC (1965)

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