The Mineral Contents of Roughages in Northern Thailand and the Requirements of Mineral for Growing Cattle.

by

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Ruminants are almost exclusively fed on fresh herbage in Thailand and the mineral requirements of cattle are not always met by it. Therefore it is necessary to know the mineral contents of the herbage fed to the cattle to find a correct supplementation. Some analyses have been performed in Chiangmai on the calcium, phosphorus, potassium and sodium contents of the roughages fed to ruminants in this area.
The mentioned minerals are essential in animal nutrition and the symptoms of deficiency are briefly described below.

Generally phosphorus is the most important element, and is of special interest for veterinarians. The main symptoms of phosphorus deficiency in cattle are infertility especially in heifers, unthriftiness, poor milk production, lameness and in extreme cases emaciation and deproved appetite (Howard 1963). In well managed farms a clinical manifestation of phosphorus deficiency is rare because phosphate supplementation avoids it. But before this supplementation was common, osteophagia or bone eating was observed in South Africa and in some cases this led to the disease called "Lamziekte" caused by the toxins of Clostridium botulinum.

In areas where soil is deficient in calcium, serious trouble occurs unless a calcium supplement is provided. Injury from calcium lack may also result if dairy cows are fed only a small quantity of poor quality grass hay with a concentrate mixture having no added calcium supplement (Morrison 1959). Dairy cows affected by a lack of calcium may be in good flesh but their milk yield may be greatly reduced and their bones may break without any an unsual strain. The hypocalcaemia or milkfever is mainly a physiological disturbance in high yielding milking cows during calving time but not a direct calcium deficiency. Potassium deficiency is generally not known for cattle because the roughages fed have adequate potassium for nutrition. Neal (1941) concluded that plant growth would fail before the amount of potassium in the plant was reduced to a level inadequate for livestock. Sodium deficiency rarely occurs because the mammalian body has considerable ability to conserve sodium. Kemp (1968) could cause a sodium deficiency in milking cows by feeding rations containing only 0.05% sodium. After two months the cows showed symptoms of sodium deficiency indicated by reduced feed intake, decreased milk yields and salt hunger. A break down occurs only after a very long period of sodium deprivation and when it dose animal collapses completely and dies (Howard 1963).

Materials, methods and results.

The calcium, potassium and contents were determined by flame photometer, the phosphorus contents by colorimeter. The results of the feedstuffs so far analysed have been published in feeding tables (Holm 1971) where the methods of the trials also been described.

The means of the calcium, phosphorus, potassium and sodium contents of the different feedstuffs are recorded per 1000 g dry matter in table 1. Some green forages from the trials in the grass garden are mentioned separately because they had exceptionally high or low mineral contents compared to the other species (Holm 1972 in preparation). The number analyses performed on the different plant groups are given in brackets.

Table 1.

Mineral contents of the roughages from Chiang Mai.

(per 1000 g dry matter)

No.	Feedstuff	Calcium	Phosphorus	Potassium	Sodium	No. of Anal.
	Dry roughages					
1.	Hay from the wet season	3,3 (24) +	3,7 (32)	9,1 (24)	0,3 (16)	
2.	from the dry season	4,8 (24)	4,3 (32)	10,0 (24)	0,5 (16)	
3.	from Guineagrass	8,9 (16)	–	–	–	
4.	from Paragrass	–	–	–	–	
5.	from Rhodesgrass	–	–	4,5 (16)	2,0 (16)	
6.	Rice straw	0,8 (4)	0,6 (4)	4,8 (4)	0,2 (4)	
	Green roughages					
	From a grassgarden					
7.	Grasses wet season	3,9 (208)	4,0 (230)	11,7 (230)	0,5 (196)	
8.	dry season	5,3 (198)	4,7 (206)	10,6 (206)	0,4 (172)	
9.	Guatemalagrass	2,5 (28)	–	–	–	
10.	Guineagrass	8,5 (66)	–	–	–	
11.	Napiergrass (hygrid)	–	6,3 (64)	18,3 (64)	–	
12.	Paragrass	–	–	–	1,4 (68)	
13.	Rhodesgrass	–	–	5,7 (64)	2,3 (64)	
14.	Legumes and other plants	12,9 (110)	4,7 (112)	21,7 (112)	0,6 (80)	
15.	Boehmeria nivea	30,1 (10)	–	–	–	
16.	Sesbaia grandiflora	–	–	–	–	
17.	Native grasses	40 (59)	2,9 (59)	19,7 (59)	0,3 (59)	
18.	Native legumes	11,4 (20)	2,7 (20)	18,6 (20)	0,5 (20)	
19.	Native plants	15,8 (37)	4,1 (37)	30,6 (37)	0,3 (37)	
20.	Corn (Guatemala)	2,1 (10)	2,6 (10)	20,6 (10)	0,5 (10)	
21.	Sorghum (bicolor)	2,4 (5)	2,8 (5)	17,5 (5)	0,5 (5)	
	Silages					
22.	Corn (Guatemala)	2,5 (3)	2,5 (3)	16,7 (3)	0,5 (3)	
23.	Paragrass	3,8 (2)	3,4 (2)	18,7 (2)	1,1 (2)	
24.	Sorghum vulgare	5,2 (3)	2,6 (3)	14,6 (3)	2,1 (3)	

+ Number of performed analyses

Table 2.

Mineral requirements for ruminants in g per day. +

Ruminant	Calcium	Phosphorus	Potassium	Sodium
Calves	12	10	16–20	5–7
Growing cattle	25	10–15	–	10–15
Milking cows, 10 kg milk	50–60	40	70–80	20
Milking cows, 20 kg milk	85–90	50–55	100–110	30
older cattle (maintenance)	20–25	15–20	40–50	10
Lamb	2,5	2	–	1
Fattening lambs	3,5	3	–	–
Pregnant ewes (begin)	4,5	3,5	–	2
Pregnant ewes (3–5 months)	5	4	–	2
Sugging ewes	8–12	6–8	–	4

Buffalo will be given by prof. Fisher

+ According to the compilation of the literature by Schmidt–Burr (1971).

Discussions.

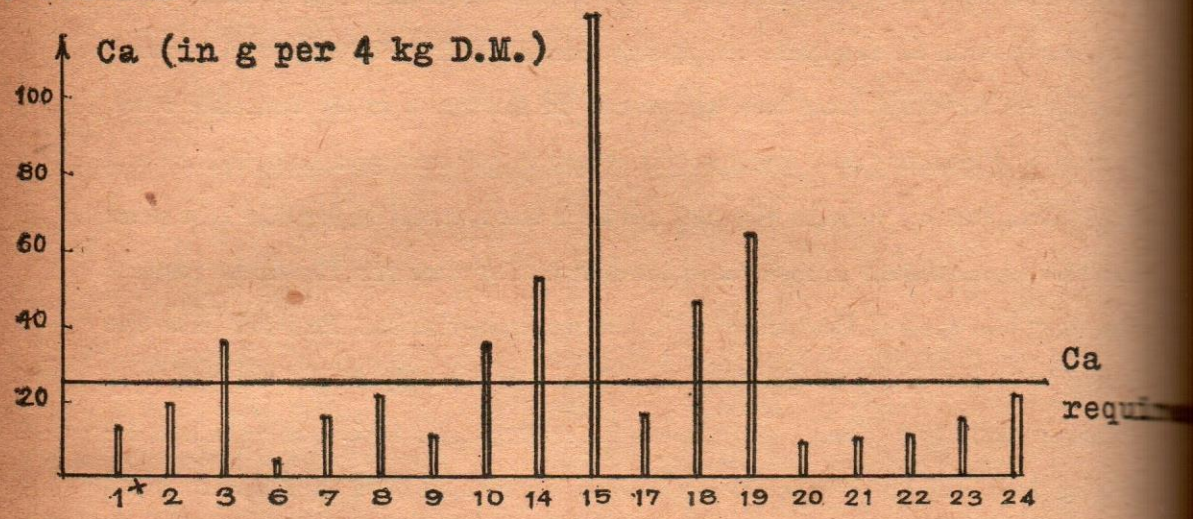
Many trials have been performed to find the mineral requirements of livestock. Table 2 shows the data for ruminants compiled by Schmidt Burr (1971) from the literature. The figures for cattle have been worked out for Bos taurus in the temperate zones. Harrock and Phillips (1964) found no differences in sodium, potassium, calcium and magnesium balances between Hereford and Zebu steers, except the fact that Zebu steers excreted less potassium in their faeces and more in their urine than Herefords. So these data may also apply to Bos indicus and its different cross–breeds in Thailand. Since the native cattle and nearly all the dairy cows have a lower body weight compared to European cattle (the mineral requirements for milking cows have been calculated for 600 kg. body weight) the mineral requirements for milking cows in Thailand should be at least 20% lower than the figures shown in table 2, with the exception of sodium which might be expected to be higher because of perspiration in a tropical environment.

The calcium, phosphorus and sodium contents in the roughages and the mineral requirements that are expected for growing cattle are shown in Fig. 1. A bull fattening trial run by the Nutrition Laboratory of the Livestock breeding station, Huey Kaeo has proved that German Brown, Black and White crossbred bulls have a daily dry matter intake of 3.8 – 4.2 kg. green corn with body weights from 160 to 210 kg. This group of bulls is fed only with roughage ad libitum thus representing an extensive feeding level similar to the conditions to be found on the farms in Chiang Mai. In Fig. 1, the data from the roughages in table 1 have been converted to a 4 kg dry matter basis, which equals the average dry matter intake of the bulls. The different plant groups in Fig. 1 are indicated by the numbers already mentioned in table 1.

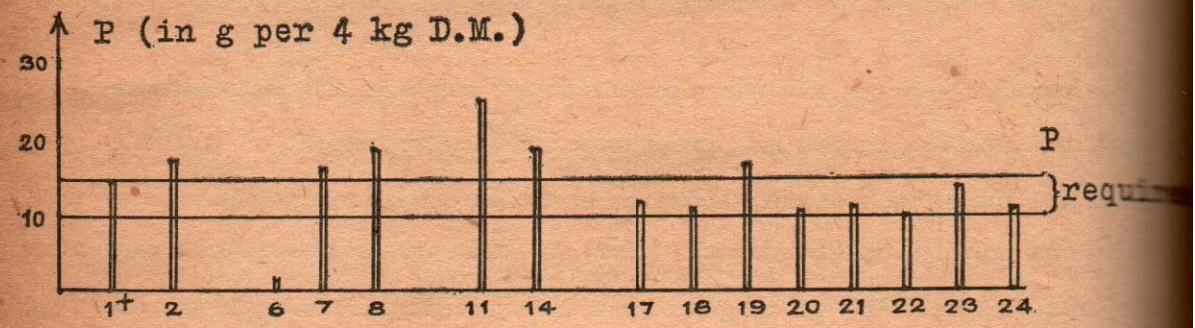
Fig. 1 a, b, c.

Mineral amounts in the different roughages based on 4 kg dry matter and the daily requirements of growing buls.l

a. Calcium



b. Phosphorus



c. Sodium

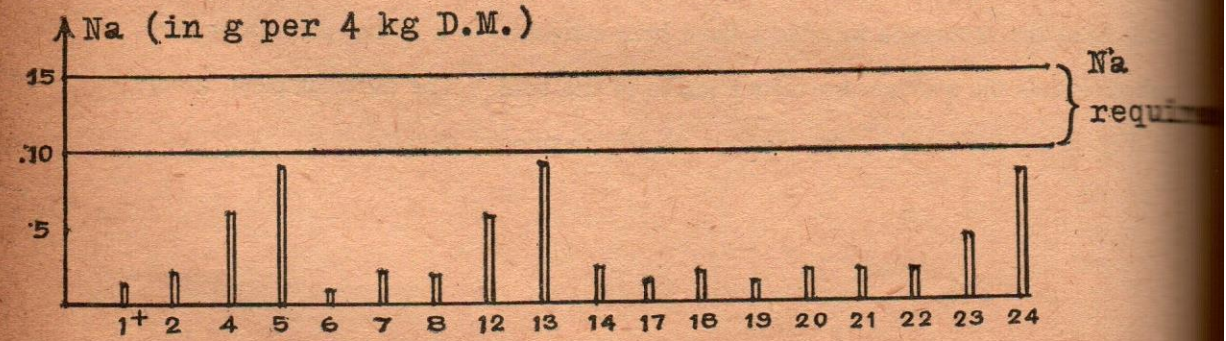


Fig. 1 a, b, c.

Mineral amounts in the different roughages based on 4 kg. dry matter and the daily requirements for growing bulls.

It is obvious from the graphs of the calcium, phosphorus and sodium contents that there are considerable differences in the mineral contents of the plant groups. The calcium and the sodium contents vary far more significantly than the phosphorus contents do. All the phosphorus contents in the roughages except ricestraw, seem to be high enough to meet the requirements of growing cattle. The low calcium content of the grasses demonstrate the need to find suitable legumes growing in the Chiangmai area. All the plants had sodium contents too low to meet the requirements of growing cattle (see Fig. 1c).

Conclusion.

The veterinary service may rarely expect any phosphorus deficiency areas used extensively for cattle grazing in Chiangmai. Special attention should be given to those farms where only tropical grasses are fed. A calcium deficiency may occur which can easily be kept under control by offering limestone. As sodium is deficient in all plants compared to the requirements salt licks should always be offered to cattle.

Summary

24 different roughages were analysed for their calcium, phosphorus, potassium and sodium contents. The mineral contents in the roughages were compared to mineral requirements in growing cattle with a daily dry matter intake of 4 kg roughage. The phosphorus contents of the forages were sufficient to meet requirements. The calcium contents from the tropical grasses except Guineagrass, and the sodium contents from all the roughages were below requirements.

Acknowledgement.

The author wishes to thank Miss B. Boonthum (B. Sc-), Miss P. Chutima (B. Sc.), Miss U. Punya (B. Sc.), and Mr. M. Titayavan (B. Sc.), for field and analyses work. I am especially grateful to Prof. Dr. Kasin Suvatabandhu for the botanical identification of the plants. Furthermore I thank the Livestock Department in Bangkok and the Livestock Breeding Station in Huey Kaeo for working assistance and running costs for all the trials.

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