West Virginia University Extension Service

Forage Quality - Minerals

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Livestock need minerals for skeletal growth, milk production, and the maintenance of body fluids and enzyme systems. The mineral content of forages varies and depends primarily on the plant species present in the forage (Table 1). Sometimes low soil fertility limits plant growth. Fertilizing and liming may change the botanical composition of the stand thereby changing the mineral levels in the forage sampled from the field. For example, phosphorus fertilization and liming may increase legume growth. An increase in the percent legume in the stand increases the calcium content of the forage. TRIM Fact Sheets 3201, 3212, and 5202 discuss fertilizer management for optimizing forage production.

Calcium (Ca) - Animals need Ca for skeletal growth, milk production, nerve impulse transmission, and the maintenance of enzyme systems. The Ca content of forages increases as the legume content of the stand increases (Table 1). The Ca content of pasture and hay usually is adequate to meet the needs of lactating and growing cattle (Table 2). Some grass pastures may not have sufficient Ca. Lime provides Ca to the soil. When used with other needed fertilizers and legume seeding, liming can significantly increase the Ca content in the forage produced.

Phosphorus (P) - Animals need P for skeletal growth and for energy metabolism. The P content is similar across different forage types but is higher in pastures than in hay crops. The P content of pasture usually is adequate for lactating and growing cattle. On pastures with soils testing low in P, fertilization with P may increase plant growth and forage P content.

Magnesium (Mg) - Animals need Mg for skeletal growth, milk production, nerve impulse transmission, muscular control, and the maintenance of enzyme systems. The Mg content in forage is higher whenthere are legumes present. The Mg content of grass forages can be marginally adequate for lactating cows and a supplement should be considered. Excessive use of K fertilizers or use of K and nitrogen fertilizer can reduce the availability of Mg to cattle consuming the forage. This is especially true for spring grass pastures fertilized with nitrogen and potassium. Low Mg availability from pastures or hay results in grass or winter tetany in cattle. When soils test low in Mg, dolomitic lime should be used to increase the availability of Mg to plants. TRIM Fact Sheet 3216 discuss how to reduce the potential for grass tetany.

Potassium (K) - Animals need K for milk production, maintenance of body fluids, nerve impulse transmission, muscle contraction, and the maintenance of enzyme systems. The K content in forage differs little among pasture types. The K content of forage usually will meet the needs of the lactating dairy cow as long as the grain supplement is not more than 40-50% of total dry matter intake. High K content in a forage can reduce the animals uptake of Mg from the diet.

Sodium (Na) - Animals need Na for glucose and amino acid transport, maintaining body fluids, and acid-base balance. Pastures contain only 0.029% Na. When salt is not supplemented to cattle and sheep,

Na can be the limiting nutrient in the diet. Adequate salt should be provided to livestock to ensure that they meet their needs for sodium.

Sulfur (S) - Animals need sulfur for rumen bacterial growth and protein synthesis. The S content in pasture samples averages 0.32% dry matter. The S content is higher in grass than in legume pastures. The S content in pastures in the Northeast is usually adequate. The availability of S to animals is greater when they obtain it from the forage rather than from a mineral supplement. When S is deficient in the forage, it is best to use S as a fertilizer.

Trace minerals - These are minerals needed in the ration in low concentrations. Trace minerals include iron (Fe), zinc (Zn), copper (Cu), manganese Mn), cobalt (Co), molybdenum (Mo), selenium (Se), and iodine (I). The forage content of Se and I usually are inadequate in the Northeast. Other minerals, such as Zn and Cu, are frequently inadequate. These minerals should be provided in a salt-mineral supplement. Thefeeding of supplemental minerals in inexpensive. They should be used where pasture mineral content does not ensure optimal animal production. A combination of equal portions of a mineral mix and trace mineral salt may be used. When P is provided as a supplement, use a 2:1 ratio mineral (Ca:P) on grass pastures and a 1:1 mineral on pastures containing legumes.

Table 1. Calcium (Ca), phosphorus (P), magnesium (Mg), potassium (K), and sulfur (S) content of pastures in the Northeast (average ± standard deviation) and supplemental grains used for cattle (adapted from Rayburn 1994 and Sirois 1995).

Feed	Ca	P	Mg	K	S
			% Dry Matter		
Pasture					
Grass	0.43 ± .22	0.38 ± 08	0.22 ± .05	3.38 ± .71	0.32 ± .07
Mixed mostly grass	0.75 ± .22	0.38 ± .08	0.26 ± .05	2.76 ± .71	0.33 ± .07
Mixed mostly legume	1.99 ± .22	0.35 ± .08	0.29 ±0.05	2.65 ± .71	0.30 ± .07
Legume	1.21 ± .22	0.33 ± .08	0.30 ± .05	3.07 ± .71	0.26 ± .07
Hay					
Grass	0.55 ± .21	0.22 ± .06	0.21 ± .06	1.84 ± .57	0.19 ± .09
Mixed mostly grass	0.75 ± .29	0.23 ± .06	0.23 ± .05	1.93 ± .53	0.15 ± .06
Mixed mostly legume	1.14 ± .29	0.25 ± .05	0.26 ± .05	2.26 ± .47	0.18 ± .06
Legume	1.46 ± .29	0.25 ± .05	0.29 ± .06	2.58 ± .51	0.26 ± .07
Silage					
Grass	0.67 ± .26	0.23 ± .08	0.22 ±0.06	2.35 ± .86	0.22 ± .08
Mixed mostly grass	0.87 ± .27	0.28 ± .06	0.23 ± .05	2.29 ± .67	0.20 ± .06
Mixed mostly legume	1.14 ± .25	0.29 ± .05	0.25 ± .05	2.54 ± .59	0.22 ± .06
Legume	1.26 ± .23	0.30 ± .06	0.25 ± .05	2.64 ± .55	0.23 ± .06
Corn	0.25 ± .09	0.21 ± .03	0.18 ± .03	1.01 ± .24	0.09 ± .03
Energy and protein supplements					
barley	0.09 ± .07	0.38 ± .06	0.14 ± .03	0.58 ± .13	0.11 ± .03
blood meal	0.13 0.08	0.16 0.07	0.03	0.30 ± .10	0.56 ± .12
brewers grains, wet	0.33 ± .17	0.60 ± .09	0.23 ± .05	0.15 ± .15	0.34 ± .07
corn, dry	0.02	0.30 ± .03	0.13	0.42 ± .06	0.09
corn, high moisture shell	0.02	0.30 ± .03	0.13	0.42 ± .06	0.09

corn, high moisture ear	0.03 ± .03	0.27 ± .03	0.12	0.48 ± .06	0.08
cottonseed, whole	0.16 ± .05	0.60 ± .08	0.37 ± .03	1.19 ± .11	0.22 ± .07
distillers grains, dry	0.18 ± .16	0.80 ± .11	0.32 ± .06	1.08 ± .25	0.40 ± .12
poultry litter	4.07 ± .31	1.94 ± .46	0.57 ± .13	2.46 ± .55	0.56 ± .20
oats	0.13 ±	0.38 0.08	0.15 ± .03	0.52 ± .10	0.16
soybeans	0.25 ± .06	0.66 ± .11	0.26 ± .03	1.99 ± .23	0.34 ± .07
soybeans, heated	0.29 ± .08	0.64 ± .09	0.27 ± .03	2.14 ± .20	0.37
soybean meal	0.40 ± .31	0.71 ± .17	0.29 ± .06	2.34 ± .19	0.39 ± .06
wheat	0.06 ± .03	0.44 ± .25	0.17 ± .11	0.56 ± .28	0.13 ± .03
wheat, midds	0.13 ± .07	0.98 ± .21	0.42 ± .09	1.15 ± .17	0.25

Table 2. Recommended mineral content of rations for a 1350 lb., second lactation cow, which will provide the animal's mineral needs at different levels of production.

Milk	Ca	P	Mg	K	S	Na
lb. /day			% Dry Matter			
20	0.43	0.28	0.30	1.2	0.2	0.18
50	0.53	0.34	0.30	1.2	0.2	0.18
70	0.60	0.38	0.30	1.2	0.2	0.18
90	0.65	0.42	0.30	1.2	0.2	0.18
110	0.66	0.42	0.30	1.2	0.2	0.18

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Return to:  Forage-Livestock Systems | Fact Sheet TOC | Top of File