GRASS TETANY

by H. F. Mayland and D. L. Grunes

Grass tetany. Grass tetany is a magnesium (Mg) deficiency in cattle and other ruminants that has caused many livestock deaths in the United States and throughout the world. The occurrence of grass tetany depends greatly on forage constituents that reduce the availability of dietary Mg. Recent research findings are increasing our understanding of this difficult nutritional problem.

Forage low in Mg. When cattle are grazing forage containing less than 0.2% Mg, grass tetany may occur. The type of forage eaten by the animal is very important. For example, grasses and legumes contain an average of 0.14 and 0.26% Mg, respectively. Mature timothy hay may contain as little as 0.07% Mg. However, hay is less likely to lead to tetany than is fresh forage because the Mg in hay is more available to cattle.

Forage Mg levels vary because of cultural practices that affect the actual amount of soluble Mg in the soil or its availability to plants. Fertilizing with high levels of potassium (K) often depresses Mg uptake by plants, but fertilizing with nitrogen (N) may increase Mg uptake and concentration. However, fertilizing grass-legume pastures with N may increase the proportion of grass. Thus the Mg concentration in the overall forage mixture may decrease, since grasses generally contain much lower Mg concentrations than do legumes.

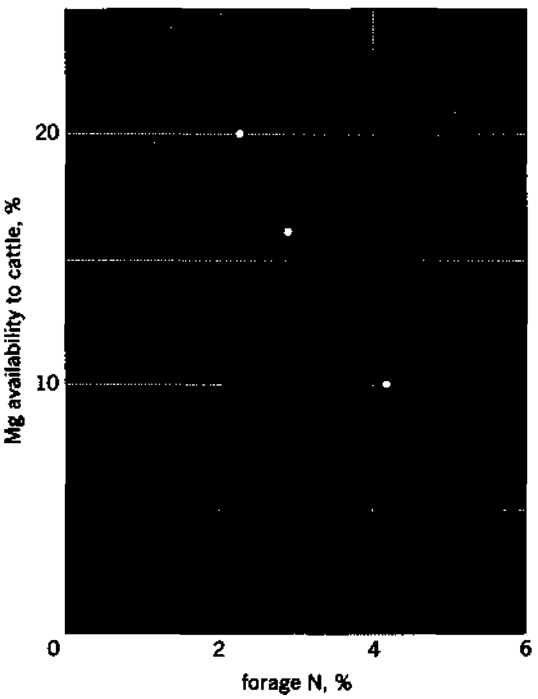

Fig. 5. Relationship between total nitrogen content of forage and "availability" to cattle of forage magnesium. *(From A. J. Metson et al., Chemical composition of pastures in relation to grass tetany in beef breeding cows, N. Z. J. Agr. Res., 9:410–436, 1966)*

Acid soils should be limed for optimum forage yields. Continued application of calcitic limestone, however, causes a gradual depletion of soil Mg sources and may ultimately lead to lower forage Mg levels and to increased incidence of grass tetany. Calcium (Ca) ions may depress Mg uptake by plants if soil Ca concentrations greatly exceed those of Mg. This effect on Mg uptake may also be observed in calcareous soils.

Organic manuring also may affect forage Mg concentrations. Poultry manure, for example, may contain 3.6% N, 1.5% K, and only 0.35% Mg. Fertilizing with poultry manure increases forage Mg concentrations. However, applying more than 4 metric tons of poultry manure (dry-weight basis) per hectare-year to pastures would be expected to greatly reduce the Mg availability to ruminants because of the high forage N and K levels produced. Thus, applying large amounts of animal litter or inorganic N and K fertilizer increases the tetany hazard.

Magnesium uptake and subsequent concentrations in grasses are temperature-related. Perennial ryegrass, when grown at constant K and Mg levels, contained 0.13% Mg when exposed to a day-night temperature of 20–14°C. At a higher day-night temperature of 26–23°C, the forage contained 0.24% Mg. Temperature may also control the type of forage available for grazing. Cool-season grasses grow better at lower temperatures than do most legumes. Thus forage in a mixed grass-legume pasture may consist primarily of grasses during the early spring when tetany usually occurs.

Reduced availability of forage Mg. The reduction in dietary Mg availability is most often associated with rapidly growing grass forage. High concentrations of K in the forage may reduce dietary utilization of Mg by cattle. Tetany has often occurred in pastures where the forage K concentration is 3% or greater, and values approaching 4% K should certainly cause concern. The incidence of tetany increases greatly when the forage K/(Ca + Mg) values exceed 2.2 on an equivalent basis. Magnesium in forage having high N levels also is less available to cattle (Fig. 5).

Availability to livestock can also be reduced when the Mg is complexed with certain organic compounds. Such tricarboxylic acids as citric and *trans*-aconitic may complex Mg, but these acids are not likely to be the most important factor in reducing Mg availability to animals. Long-chain fatty acids may also complex with Mg, forming water-insoluble soaps that are excreted in the feces. The concentration of long-chain fatty acids in forage is directly proportional to the N concentration. Therefore, the decreased Mg availability attributed to N (Fig. 5) may be partly due to the effect of organic complexing agents whose levels are associated with forage N concentrations.

A high ratio of N to soluble carbohydrates in the forage may be related to reduced Mg availability. Forage N values may increase under conditions of rapid forage growth and N fertilization. Soluble carbohydrates are reduced by N fertilization, and

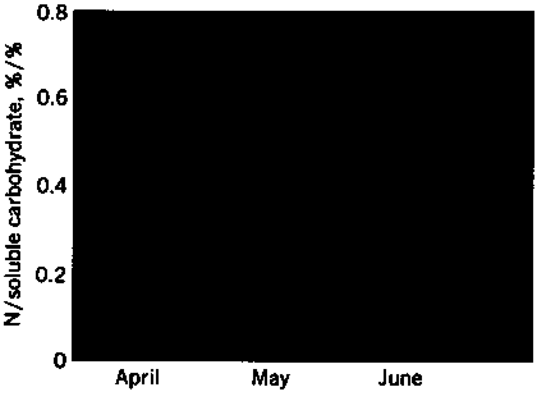

Fig. 6. Grass tetany coincided with an increase in ratio of nitrogen to soluble carbohydrate in forage. Fertilizing with 150 kg N/ha amplified the ratio increase and would likely increase the tetany hazard. (*H. F. Mayland and D. L. Grunes, unpublished data*)

concentrations are greatly decreased during rapid plant growth. Thus, environmental conditions conducive to rapid forage growth have coincided with the occurrence of grass tetany (Fig. 6).

The Mg in forage produced under low solar radiation levels may be less available to cattle. For example, when the average daily radiation levels for three consecutive spring tetany periods were 437, 547, and 551 langleys per day, the incidence of grass tetany was severe, light, and a trace, respectively.

Alternatives to reduce tetany. Several agronomic management alternatives are available for reducing the incidence of grass tetany. Pastures can be renovated to include a larger proportion of legume. Dusting forage with 30 kg/ha MgO will provide temporary protection from tetany, until the Mg is lost from the forage by wind or rain. A spray of a Mg-bentonite clay-water slurry will adhere more to the foliage and last somewhat longer than the dust. Either the dust or spray will provide Mg to the animals as they graze the treated forage.

Magnesium fertilization will increase the Mg concentration of forage grown on coarse-textured acid soils, but responses, if any, will be much smaller on fine-textured soils. Using dolomitic limestone, rather than calcitic sources, will assure some replenishment of Mg in acid soils. The dolomite solubilizes more rapidly if mixed into the soil.

Another helpful practice is to apply only a portion of the N and K fertilizer in early spring and apply the remainder later in the season. Soil test recommendations should be followed to avoid excessive N and K fertilization. Where soils are to be limed, or Mg fertilization is economical, maintenance of a balance of soil nutrients should be attempted. For Mg this includes sufficient exchangeable soil Mg to give 10 to 15% of the cation exchange capacity, Mg/K values of 2 or greater, and Mg/Ca values of 0.2 or greater (all values on an equivalent basis).

Alternatives in livestock management should also be considered in reducing the severity of grass tetany. Grazing of forage likely to produce tetany should be postponed until the danger passes. Or, such forage might be grazed by livestock having lower Mg requirements, that is, nonlactating animals. The more direct method of reducing Mg tetany is to supplement the animals with Mg. This should decrease the incidence of grass tetany, although some cases may still occur if some animals do not accept the Mg supplement.

For background information *see* ALKALOID; FESCUE; GRASS CROPS; LEGUME FORAGES in the McGraw-Hill Encyclopedia of Science and Technology. [H. F. MAYLAND; D. L. GRUNES]

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