UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Box 855
Bozeman, Montana

May 5, 1965

CONSERVATION TECHNICAL NOTE - RANGE 13

Re: Look Out for Grass Tetany
by Dr. H. J. Almquist, Vice President & Director of Research
The Grange Company, Modesto, California

"The following article on GRASS TETANY appeared in the Western Livestock Journal for October 1964."

Grass tetany of cattle occurs almost exclusively when large quantities of young spring grasses are eaten. And, in California, where the climate is mild, grass tetany can become a serious problem in October, if the rains come early enough to encourage new growth.

There is no doubt that this disease should be regarded as a simple deficiency, similar to terminal magnesium deficiency. Low blood magnesium always occurs in the affected cattle. Young grasses are very high in protein...20 - 30% of the dry matter, and a high protein diet is known to increase magnesium requirement.

Symptoms of the tetany are hyperirritability, convulsions and finally, coma and death. The disease develops rapidly in a space of time too short for the animal to become depleted of existent stores of magnesium in the blood, but the magnesium content of the bone is not decreased. Depletion of bone magnesium, however, is characteristic in all other types of magnesium deficiency.

Cattle of all ages may be affected. Herds that are pastured in fields heavily fertilized with nitrogen are more susceptible. These grasses are often 90% or more in water content. The cow can hardly eat enough of this young grass in a day's time to meet energy requirements, especially if nursing a calf. The cow is thereby forced to metabolize a large part of the protein for energy, unless she has some additional source of energy such as dry grass, hay, molasses or grain concentrate.

Sometimes, it is necessary to graze off all the dry grass that cattle will eat, leaving nothing to eat but green grass (when it begins to grow)... a situation that is ideal for tetany. Cattle, however, will seek out dry grass when available and will blend it with the green, thus building up their energy intake, as well as a better protein to calorie ratio.

If it is not possible to retain a sufficient quantity of dry grass on the range, then extra energy in the form of hay, molasses, or a grain concentrate should be provided during the danger period... and the

concentrate should contain extra magnesium. Thus, dry hay, plus a grain concentrate with magnesium is a double-barreled preventive measure that can help even those cows that will eat hay and not concentrate, or vice versa.

As the season wears on, the grass matures; it is lower in protein and higher in energy and dry matter. Consequently, the danger of tetany diminishes.

What is the chemistry of grass tetany?

When the cow is forced to metabolize excess protein for energy, the nitrogen of protein is poorly utilized and much of it is liberated as smaller nitrogen compounds, including ammonia. Proteins of young grasses are especially high in amide ammonia which is easily split off. The rumen of a cow suffering from grass tetany is actually alkaline and contains free ammonia, detectable by odor and chemical test. The disease can be produced experimentally by feeding a normal diet, supplemented with ammonium carbonate sufficient to raise the ammonium content of the rumen to that encountered in field cases.

Under alkaline conditions and with free ammonia present, magnesium is converted to an insoluble and unavailable form known as magnesium ammonium phosphate. This process will pull the magnesium ions out of the blood and thereby bring on the acute phase of magnesium tetany.

The tetany is a terminal event in a series of processes that started from a relative energy deficiency. Magnesium tetany can be treated effectively in the terminal stage only by injecting magnesium for direct absorption into the blood, without interference in the rumen. Often a combination of magnesium, calcium glucose is injected.

We hear of the use of extravagant levels of magnesium oxide in supplemental feed, up to 14% to prevent grass tetany. The only reason advanced for the preference for the oxide over the sulfate is that someone said the former is more available.

The facts are that the oxide is very slightly soluble, while the sulfate is readily and completely soluble. The oxide will dissolve in water to the extent of one part in 7,700 parts of water. The sulfate dissolves to the extent of one part in about one part of water. Of course, the cow may generate enough acid to dissolve the magnesium oxide, but there may be considerable doubt that this process will handle the huge doses suggested, especially when the cow is on the verge of an alkaline condition.

The use of these very high levels of magnesium oxide has probably come about because the other phase of the preventive procedure, namely, providing more non-protein energy was not applied at the same time.

Magnesium oxide is known to the chemist as a two-phase buffer. It automatically maintains a pH (a chemist's symbol for expressing active acidity or alkalinity) of 10 - 11, which is definitely alkaline and detrimental to rumen microorganisms. If the dissolved magnesium oxide

is reacted by acids, a little more of the oxide then dissolves to restore the alkaline pH. Magnesium oxide is a commonly used reagent in the laboratory for splitting off amide ammonia from plant proteins, exactly what we do not want to happen in the rumen. Magnesium oxide tends to enhance an alkaline condition in the rumen.

The alkalinity, as stated previously, is one of the conditions for the formation of magnesium ammonium phosphate, or magnesium triphosphate, both of which are very insoluble. Calcium phosphates can also be converted to insoluble forms under similar conditions.

The intake of massive doses of magnesium oxide may, by sheer quantity, provide enough magnesium to prevent loss of this element from the blood and thus prevent acute and lethal phase of grass tetany. The conditions outlined here, however, are ideal for the formation and loss of excessive amounts of phosphate as the magnesium ammonium phosphate or triphosphate, or calcium phosphate. Phosphate deprivation is not a quick killer, but no one would consider it a desirable condition to maintain for any length of time.

Rickets and phosphate deficiency following high magnesium intake are demonstrated conditions in animals. High magnesium intake results in the sweeping out and loss of trace elements such as manganese, copper, iron. The effects of such loss would be felt slowly, but certainly.

The commonly known form of magnesium sulfate is Epsom salts, a hydrated product containing 10% magnesium. The sulfate part of Epsom salts is further available to cattle in meeting part of their sulfur requirements for growth and lactation. There is plenty of evidence on this point.

The cattle range breeder supplement we produce contains only enough Epsom salts to build up the magnesium content to 0.25%, or 2,250 milligrams of magnesium if the cow eats at least two pounds a day, which she will, if getting only green grass. This provides ample, rapidly available magnesium and extra energy with no undesirable side effects. Magnesium sulfate makes a neutral solution and has little or no effect on rumen acidity or alkalinity or on rumen microorganisms.

In view of the potential dangers in the use of magnesium oxide, we use sulfate. Not only is much less sulfate needed, but it presents no threat of damage in its continued use, even if stocks of range supplement are consumed after the grass tetany danger period has passed.

Distribution: AFL and PT Specialists

File: REFERENCE MATERIAL - Range