

Grass Forages and Magnesium Status of Dairy Cattle

by Patrick Hoffman and John Peters

Introduction

Forage grasses are an important source of dry matter in dairy cattle diets. Agronomic practices associated with grass forage production however can alter magnesium utilization by dairy cattle. Altered magnesium utilization induced when cattle graze lush forage grasses is referred to as grass tetany. Historic use of vocabulary directly associating the term grass tetany with grazing lush spring grasses has resulted in many misconceptions about the relationship between producing and feeding forage grasses and the potential for hypomagnesaemia (low blood magnesium) in dairy cattle. Hypomagnesaemia is possible in dairy cows when feeding significant amounts of ensiled, baled or grazed grass forage. Dietary magnesium status also plays a key role with milk fever in dairy cows at the time of calving. In most cases hypomagnesaemia is not a major problem in dairy cattle but certain agronomic grass forage production practices can create a “perfect storm” increasing the risk of acute health problems in dairy cows associated with dietary magnesium status. The focus on forage paper will highlight risk potentials between forage grass production, feeding and hypomagnesaemia in dairy cattle.

What is Hypomagnesaemia?

Hypomagnesemia (or hypomagnesaemia) is an electrolyte imbalance in which there is a low level of magnesium in the blood. Hypomagnesemia occurs when loss of Mg in milk, urine, digestive secretions, or sweat is higher than the dietary intake of Mg. Unlike calcium or phosphorus, dairy cattle cannot resorb Mg from bone to meet Mg requirements during short periods of deficiency. In acute clinical cases animals will exhibit muscular spasms, convulsions, or extreme muscular weakness and may die. Acute occurrence of hypomagnesemia in lactating dairy cows is rare but occurrence of hypomagnesemia in combination with milk fever (hypocalcaemia) is much more common. Often hypomagnesemia occurs at calving and it can

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easily be mistaken for milk fever. Typical signs in dairy cows are cows unresponsive to typical milk fever treatments, stiff rear legs and neck, difficulty rising from a lying position, falling, or mild tremors. Older dairy cattle are more affected than young cattle. Mild hypomagnesemia concurrent with milk fever is challenging to assess because animal symptoms are so similar. In general cows with true milk fever (hypocalcaemia) appear calm but unable to rise or get up. Dairy cows with hypomagnesemia will appear more agitated, nervous and exhibit tremors when trying to rise or get up. In either case a veterinarian should be consulted for final determinations.

Forage Grasses and the Perfect Magnesium Storm?

Exchangeable soil Mg levels are related to the mineralogy of the parent soil and the cation exchange capacity, which is highly dependent on the clay minerals present. Because Wisconsin has such diverse soil mineralogy, Mg uptake in grasses may be different regionally depending on soil type. Plant uptake of Mg is affected by the level of exchangeable Mg present in the root zone as well as influenced by the amount of other cations present such as K and Ca. In very acid soils (low pH) Mg uptake by forage grasses is generally reduced compared to neutral soils and supplemental Mg may be required for improved crop yields. Adding to the complexity of plant Mg uptake is the interaction of soil K levels on the concentration of Mg in plants. It is well documented that greater soil K concentrations depresses the uptake of Mg by plants. Further adding to the biological complexity is grasses grown under the aforementioned soil conditions may accumulate high concentrations of a compound called trans-aconitate. When trans-aconitate is fed to ruminants, rumen bacteria convert trans-aconitate to tricarballoylate. On the animal side, grasses higher in K may be lower in Mg. It is also known that dietary K competes for Mg absorption sites in ruminant animals and it is also known that tricarballoylate plays a major role in hypomagnesemia; the perfect storm.

A practical example of a situation which may cause the perfect storm associated with hypomagnesemia is a follows. A dairy producer in central Wisconsin establishes an alfalfa-grass stand on a soil with a below optimum pH and low CEC with relatively high soil K levels compared to exchangeable Mg levels.

The alfalfa portion of the stand dies out due to sub-optimal soil pH conditions and the majority of the stand becomes grass. The dairy producer retains the grass stand as an N sink applying heavy manure applications and retains the grass as silage for dry and transition cows. Forage mineral analysis is not used and the low Mg, high K concentration in the forage is not recognized and the forage unknowingly contains trans-aconitate. Milk fever-like symptoms occur 0-14 days post-calving and are difficult to treat. Note: in severe cases of hypomagnesemia, milk fever-like symptoms will occur at any stage of lactation.

Managing Grass Forages for Dairy Cows

Hypomagnesemia is not a common occurrence but acute events can be challenging to diagnose and may result in heavy cow losses in short periods of time if not properly identified. Whenever a high percentage of grass forages are fed to transition and lactating dairy cows simple, cost effective management prevention is generally all that is required. The following prevention steps should be taken.

- 1) Test grass forages fed to dry and transition cows for Ca, P, K, Mg, Na, Cl and S using wet chemistry.
- 2) Considering increasing the dietary Mg concentration to 0.40-0.45 % of DM using a low cost Mg supplement such as magnesium oxide.
- 3) Consider administration of oral supplements or boluses containing Mg immediately post-calving to supply Mg during periods of very low feed intake.

In regard to forage grass production for dairy cattle, basic forage production practices can help minimize the risk of low plant Mg or trans-aconitate accumulation in forage grasses.

- 1) Routinely soil test
- 2) Apply lime to retain soil pH near optimum levels. If your soil test Mg levels are low, make sure and use a dolomitic limestone, which will supply both Ca and Mg to the soil.
- 3) Do not apply K to soils with excessive K levels
- 4) Do not apply excessive amounts of high K manure to grass forages.

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