GrowGreen FERTILISER

TECHNICAL PAPER — PASTURE & LIVESTOCK

Grass Tetany

Understanding and Managing the Risk in Livestock

How soil conditions, fertiliser practice, pasture species and animal demand combine to drive low blood magnesium in grazing cattle, and the integrated soil, pasture and supplementation steps that reduce the risk.

AUTHOR
GrowGreen Fertiliser
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1. Introduction

Grass tetany, also known as hypomagnesaemia, is a serious metabolic disorder affecting cattle and other grazing ruminants. It occurs when the concentration of magnesium in the blood falls below the level required to maintain normal nerve and muscle function. The condition can develop rapidly and may result in reduced animal performance, veterinary intervention or mortality, making it an important concern for livestock producers.

The risk is often associated with rapidly growing, highly digestible pasture, particularly when forage magnesium and calcium concentrations are low or when elevated potassium and ammonium levels interfere with magnesium absorption. Soil conditions, fertiliser practices, pasture species, weather and the animal's physiological requirements can all influence the overall level of risk. Grass tetany should therefore be understood as the result of a complex interaction between the soil, the plant and the grazing animal rather than a simple magnesium deficiency in isolation.

Pasture management plays an important role in reducing this risk. Soil testing, balanced fertilisation, appropriate grazing practices, forage mineral monitoring and direct livestock supplementation may all form part of an integrated management strategy. Improving the magnesium status of pasture can contribute to a more suitable forage mineral profile, although pasture fertilisation should not be regarded as a replacement for professional animal-health advice or direct supplementation when livestock are considered at risk.

This article examines the major factors associated with grass tetany, including soil and plant nutrition, interactions between magnesium and other nutrients, forage selection and practical management options. It also considers how biological nutrition and amino-acid-based formulations may complement magnesium management within the plant as part of a broader pasture and livestock nutrition strategy.

Occurrence and Contributing Factors

Grass tetany is most commonly associated with periods of rapid pasture growth, particularly during spring and autumn when favourable rainfall, cool soil temperatures and increasing

day length promote the production of lush, highly digestible forage. During these periods, pasture growth often outpaces the accumulation of mineral nutrients, resulting in forage that may not always provide an optimal mineral balance for grazing livestock.

Environmental and soil conditions play an important role in determining the magnesium content of pasture. Soil temperature, moisture, pH and drainage all influence root activity and nutrient availability, while fertiliser practices can further affect the balance between magnesium and other essential nutrients. As a result, the mineral composition of forage is continually influenced by both natural conditions and pasture management decisions.

The nutritional status of the grazing animal is equally important. Lactating cows are particularly susceptible to grass tetany because milk production substantially increases their daily magnesium requirements, while the body's ability to store magnesium remains limited. When these increased nutritional demands coincide with periods of reduced magnesium availability in pasture, the risk of developing grass tetany increases.

Pasture species also contribute to the overall risk. Different grasses and forage cultivars vary naturally in their ability to absorb and accumulate magnesium, meaning that the mineral composition of pasture can differ considerably between grazing systems. Deep-rooted species such as tall fescue generally have a greater capacity to access nutrients from deeper soil profiles, whereas intensively managed perennial ryegrass pastures are more frequently associated with conditions that increase the risk of grass tetany, particularly during periods of rapid spring growth and high nitrogen or potassium fertilisation. Together, weather conditions, soil characteristics, pasture species, fertiliser management and animal nutritional requirements determine the likelihood of grass tetany occurring within a production system.

3. Soil-Plant Interactions

3.1 Magnesium Uptake by Plant Roots

For magnesium to contribute to plant growth and development, it must first be absorbed by the plant and transported to the tissues where it is required. This can occur through the root system from the soil solution or, when appropriate, through foliar applications that deliver magnesium directly to the leaf surface. In both cases, successful plant nutrition depends not

only on the availability of magnesium but also on the plant's physiological capacity to absorb, utilise and redistribute this essential nutrient.

Healthy, actively growing plants are generally more efficient at acquiring magnesium. Environmental conditions such as soil moisture, soil temperature and overall plant health influence nutrient uptake, while root development remains fundamental for the continuous supply of magnesium from the soil. Foliar nutrition, however, provides an additional pathway to complement magnesium availability during periods of high demand or when soil conditions temporarily limit nutrient uptake.

Once absorbed, magnesium is transported throughout the plant where it supports chlorophyll production, enzyme activation and carbohydrate metabolism. Because magnesium is mobile within the plant, it can be redistributed from older leaves to younger, actively growing tissues, making a continuous and balanced supply important throughout the growing season.

3.2 Nutrient Interactions Within the Soil

The availability of magnesium to plants depends not only on the quantity present in the soil but also on its interaction with other nutrients. Because nutrient uptake is a dynamic process, an excess of certain elements can reduce the plant's ability to absorb magnesium, even when soil magnesium concentrations are considered adequate. This nutrient antagonism is one of the principal factors contributing to reduced magnesium levels in pasture.

Potassium is the nutrient most commonly associated with this interaction. High soil potassium concentrations, particularly following repeated applications of potassium fertilisers or intensive grazing systems, can compete with magnesium for uptake by plant roots. As potassium availability increases, magnesium absorption may decline, resulting in pasture with a less favourable mineral balance for grazing livestock.

Nitrogen management can also influence magnesium nutrition. Research has shown that ammonium-based fertilisers may reduce the uptake of magnesium and calcium under certain soil conditions by increasing competition between positively charged ions at the root

surface. This interaction is particularly relevant during periods of rapid spring growth, when ammonium fertilisers are commonly applied to stimulate pasture production.

In addition to nutrient competition, soil chemistry also influences magnesium availability. Acidic soils can reduce the availability of magnesium by increasing the solubility of aluminium and manganese, which may interfere with magnesium uptake and alter nutrient balance within the soil–plant system. Maintaining an appropriate soil pH and balanced soil fertility, rather than focusing on individual nutrients, is therefore essential for producing pasture with an appropriate mineral composition.

3.3 Magnesium Movement Within the Plant

Once magnesium has been absorbed, it is transported to tissues where it supports essential physiological processes, particularly chlorophyll formation, photosynthesis, enzyme activation and carbohydrate metabolism. Unlike relatively immobile nutrients such as calcium, magnesium is mobile within the plant and can be redistributed between tissues according to physiological demand.

This mobility becomes particularly important during rapid pasture growth. Mature, photosynthetically active leaves act as source tissues, while newly developing leaves and shoots represent strong sinks for nutrients and assimilates. Magnesium can therefore be remobilised from established tissues towards areas of active growth, helping maintain metabolic activity as new forage is produced.

Amino acids may complement this process through their involvement in nutrient assimilation and transport within plant tissues. Their interaction with mineral ions can contribute to the formation of soluble organic complexes, potentially supporting nutrient utilisation and movement towards metabolically active tissues. This provides a physiological basis for combining amino-acid-rich biological nutrition with magnesium, particularly during periods of active pasture growth when nutrient demand and redistribution are high.

When magnesium supply becomes limiting, its mobility also means that the plant can draw magnesium from older leaves to sustain younger tissues. Maintaining an adequate and accessible supply is therefore important not only for plant growth, but also for supporting the magnesium status of actively growing forage consumed by grazing livestock.

3.4 The Role of Amino Acids in Magnesium Nutrition

Magnesium does not function independently within the plant. It is involved in chlorophyll formation, photosynthetic reactions, enzyme activation and cellular energy transfer, while amino acids provide the organic building blocks required to sustain the metabolic machinery responsible for plant growth.

This relationship is particularly important during active pasture development, when photosynthetic and metabolic activity increase rapidly. Magnesium supports the capture and conversion of light energy, while amino acids contribute to the production and renewal of the proteins required to maintain these processes. Together, they support the physiological activity necessary for continued leaf development and forage production.

Supplying magnesium within an amino-acid-rich biological matrix therefore combines an essential mineral with organic compounds directly involved in plant metabolism. Rather than considering magnesium nutrition simply as the addition of a mineral, this approach recognises that its value ultimately depends on the physiological processes in which that magnesium is used.

3.5 Linking Plant Physiology to Pasture Quality

The nutritional value of pasture depends not only on the amount of forage produced, but also on the concentration and balance of minerals contained within the tissues consumed by livestock. For magnesium, vigorous growth alone does not necessarily ensure that the forage will provide an adequate dietary supply, particularly during periods when new biomass is being produced rapidly.

This makes the magnesium status of actively growing leaves an important consideration in pasture nutrition. Strategies that maintain magnesium availability to plant tissues, including complementary foliar nutrition when soil-derived uptake is constrained, can help support the mineral composition of the resulting forage. The objective is therefore not simply greater pasture production, but the development of forage with an appropriate nutritional profile for grazing livestock.

By approaching magnesium management at the plant level, pasture nutrition becomes part of the wider strategy for managing magnesium intake in grazing systems. Supporting both

mineral availability and the physiological processes responsible for its uptake and utilisation provides a practical link between plant nutrition, forage quality and livestock nutrition.

4. Management and Prevention Strategies

Grass tetany prevention requires an integrated approach because pasture magnesium concentration represents only one part of the soil–plant–animal relationship. Management should aim to maintain an appropriate mineral balance in the forage while recognising that animals at higher risk may still require direct magnesium supplementation. The source material specifically supports combining soil and forage management, strategic fertilisation, supplementation and forage selection rather than relying on a single intervention.

Soil and forage testing provide the foundation for this approach. Soil analysis can identify magnesium availability and pH conditions that may restrict nutrient availability, while forage analysis provides a more direct indication of the mineral composition actually being consumed by livestock. This distinction is important because adequate soil magnesium does not necessarily translate into adequate magnesium concentrations in the pasture.

Fertiliser programs should consider nutrient balance rather than magnesium in isolation. Where magnesium availability is inadequate, magnesium fertilisation can be used to increase the nutrient available to the pasture. At the same time, excessive potassium and ammonium inputs should be carefully managed because both have been associated with conditions that reduce magnesium uptake and contribute to an unfavourable forage mineral balance.

Foliar magnesium can provide a complementary nutritional pathway by delivering the nutrient directly to plant foliage, particularly where soil conditions constrain root acquisition. This approach can be integrated with biological inputs that support nutrient uptake and nutrient-use efficiency, concepts also identified in the uploaded pasture literature on biostimulants.

Pasture selection can also form part of a longer-term magnesium management strategy. Different forage species and cultivars vary in their capacity to accumulate magnesium, meaning pasture composition can influence the mineral profile ultimately available to grazing livestock.

Finally, pasture-based strategies should complement rather than replace animal nutrition management. Magnesium-rich supplements are commonly used during higher-risk periods, particularly where forage alone may not meet animal requirements. Combining appropriate pasture nutrition with direct supplementation where required provides a more comprehensive strategy for managing grass tetany risk.

5. Conclusion

Grass tetany demonstrates how closely pasture nutrition and livestock nutrition are connected. Managing the risk requires attention to the quality of the forage being produced, particularly its mineral composition, rather than considering pasture productivity alone.

A well-designed nutritional strategy should therefore focus on creating conditions that favour an appropriate magnesium status in the growing pasture while recognising the wider requirements of the grazing animal. Combining informed pasture management with appropriate animal supplementation where required provides a more complete approach than relying on any single intervention.

Ultimately, improving our understanding of the soil–plant–animal relationship creates opportunities to manage pasture more precisely. By considering mineral nutrition alongside plant physiology and forage quality, producers can make more informed decisions that support productive pastures and nutritionally balanced grazing systems.