Avoiding Grass Tetany

Tips and tricks to minimize the risk of grass tetany in your herd.

by ***Heather Smith Thomas***

Annual death loss from grass tetany costs stockmen millions of dollars, but the cause has been poorly understood. This problem affects mature cattle grazing lush forage after weather changes such as freezing early spring pastures or sudden growth after rainfall following drought. Grass tetany is also referenced as grass staggers, milk tetany, lactation tetany, winter tetany, wheat pasture poisoning, crested wheatgrass poisoning or barley poisoning.

The disease has been associated with magnesium deficiency, calcium deficiency ("milk fever") and excess potassium in the blood of affected animals. During cool, wet conditions or regrowth of plants after frost or drought damage, sodium levels in certain forage plants plummet, while nitrogen and potassium levels spike. A high level of potassium in eye fluid is common in deceased cattle.

Recommended prevention has been supplemental dietary magnesium. Standard treatment has been to give affected cows oral and/or intravenous magnesium.

Traditional treatment

After examining cattle lost in 2001, following spring frosts in the Midwestern U.S. and analyzing the pastures, Thomas Swerckzek, DVM, Ph.D., Lexington, Ky., found clues about the cause and prevention of grass tetany. "When I first came to Kentucky in 1969, people were trying to prevent it by feeding more magnesium," he says. "Cattle wouldn't eat this mineral free choice, however, because it's bitter. So farmers mixed it with corn or other feed."

He recalls each spring farmers were advised to get magnesium into their cattle when pastures were growing fastest, but this effort did not work well. Then, nutritionists told the farmers they should start providing magnesium four to five weeks before peak pasture growth. When using magnesium continued to fail, nutritionists advised year-round supplement beginning the 1980s. Theoretically, cattle would store this magnesium in their bones and could pull it out of bone storage when blood levels dropped due to sudden pasture changes.

As a veterinary pathologist, Swerczek did diagnostic necropsies on livestock until the early 1970s, before working as an equine diagnostic research pathologist. In 1986 he continued his necropsy research on all classes of livestock. When he resumed doing necropsies on cattle at that time, he was shocked to see how much worse the grass tetany situation had become. "The dead cattle were arriving at our lab in a wasted condition I'd never seen before," he recalls. "When I'd stopped doing cattle necropsies in 1971, the dead cattle were in good shape."

He says by 1995 he started seeing adult cattle with salmonellosis, coccidiosis and other calfhood diseases. This influx of disease did not make sense, so Swerczek began looking at diets and mineral mixes since they were what had changed over the years.

He collaborated with a bovine veterinarian, William McCaw, DVM, who was working with several purebred herds trying to find answers. "He thought there was something related to diet that was causing wasting and opportunistic diseases," Swerczek says. "We asked several producers if they'd be willing to stop feeding

minerals awhile, to try to figure this out. Mineral feeding was so ingrained in their idea about proper management that they thought the cattle would die without magnesium to prevent grass tetany." Some agreed to do it, however, since they were losing cattle anyway.

When Swerczek started looking at herds throughout the state, he found a farm with very healthy Hereford-Simmental crossbreds that all looked like show cattle. The owner was feeding natural mineralized loose white salt and a trace mineral salt that contained 99% salt with no supplemental magnesium.

"Most farmers in that area adjacent to this farm were feeding mineral mixes and salt-protein/mineral blocks instead of adequate loose salt," he recalls. "Most of the protein-mineral mixes only contained 18% salt or less."

Those cattle were overeating the protein-mineral mixtures in search of additional salt. He says all of those cattle were showing signs of poor health and wasting, typically seen with sodium deficiency and different forms of mineral toxicity.

The farmer with the crossbred cattle wasn't feeding any supplemental magnesium, and his cattle were all in excellent health and body condition. "He'd been in the cattle business more than 40 years and hadn't ever had a case of grass tetany, while grass tetany was endemic on near-by farms," Swerczek explains. "This was a hint that maybe adequate salt was necessary to prevent grass tetany, rather than supplemental magnesium."

Turning point

Later, Swerczek got several herds off the mineral mix, and they quickly started to turn around. Most of the cows had been suffering from diarrhea, wasting away, but within 24 to 48, hours they improved after receiving plain loose salt instead of mineral.

He recalls massive losses in Kentucky one year due to an unusual winter with many warm spells. Grass and clover grew early, and there was a hard freeze in April. He remembers cattle going down by the thousands with grass tetany and bloat. People were using bloat blocks, but it didn't help. He says cattle were actually dying while eating those because they didn't have salt.

"The reason cows go down with grass tetany is that they are short on magnesium and calcium, but I didn't know why salt worked," he explains. In an effort to answer that question, he used horses as a research model because they also suffer nitrate toxicity when grazing frost-damaged pastures, and nitrate is involved with magnesium deficiency — but horses don't get the tetany syndrome.

Swerczek fed his test horses extra protein, to get protein and nitrogen levels higher in their blood. "I knew nitrate was involved, so I measured nitrate in their blood and put some of them on salt and some on no salt," he explains. "I found that when they don't have salt the nitrate spikes. When horses had an adequate amount of salt, blood nitrate went down to very low levels.

"We'd been taught for many years [and people still believe] that nitrate is not toxic, and that nitrite is the problem," he notes. "In the 1940's when nitrate was discovered as the cause of cornstalk toxicity, it was nitrites causing shortage of oxygen in the blood. But I found that nitrate is 100 times more important in grass tetany syndrome than nitrite."

He says the body must get rid of the nitrate, and it does this through the cations in the bloodstream — especially sodium. When there isn't adequate salt in the blood, the body grabs onto the most available cation, which is magnesium and then calcium. When the spike of nitrate occurs because the cow consumes frost-damaged forage, the body immediately uses magnesium in the blood to combine with and get rid of the nitrate. This process depletes the body, and the cow goes down.

Lush green grass often lends itself to an increased risk of grass tetany.

"If there's enough salt available, the body can grab onto the sodium and cows don't go down with grass tetany or milk fever," he explains. "If you don't have salt available for cows on the day this hits, they go down. It has to be there all the time, and it can't be hard salt blocks because cattle can't eat enough of it when they suddenly need it."

Another piece of the puzzle fell into place after Swerczek found that on some farms, even though farmers supplied salt, cattle weren't eating enough of it. The potassium level in grass was spiking to 15 times higher than normal after a hard frost, especially when it was lush and highly fertilized.

"Since the cation potassium and sodium are so close together, the body can't always differentiate between them," he explains. "These minerals can substitute for one another. I theorized that when potassium spikes, even though cattle have salt available, they won't eat enough of it because the body thinks they already have enough." They are actually sodium starved, but their bodies don't know the difference between an excessive amount of potassium and too little sodium.

The body usually has the ability to keep its sodium level within a

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Many cattle suffer from grass tetany because they are sodium starved, so increasing salt in their diet is critical.

normal range, but when it drops lower, there are only a few hours before the animal dies. "If you feed salt, however, and the animals eat it, they'll be fine — as long as they have plenty of water," Swerczek says.

He and McGraw wrote a paper about their findings. They mentioned the episode of late frosts and freezes the in late spring of 2001, which affected pasture forages. During this period, they found more cases of grass tetany and acute bloat in cattle. "These cows were grazing on pastures with abundant clover," he recalls. "Cattle were dying of acute bloat, consistent with rumen tympany. This type of bloat was not the legume 'frothy bloat,' but it was related to gastrointestinal atony [lack of muscle tone or energy; inability to contract and move]."

The development of this particular bloat appears similar to the grass tetany syndrome because magnesium and calcium are depleted in the blood due to high nitrate, which disturbs muscular tissues of the gastrointestinal (GI) tract. Magnesium and calcium are critical for muscular tissues, and when a deficiency exists, atony of the GI tract occurs. This causes the tract to become more prone to torsions and gas formation.

Local bovine practitioners reported that surfactants, commonly used to prevent legume frothy bloat, were unsuccessful in resolving the bloat. "We found that cattle did not succumb to acute bloating when adequate loose salt was available," Swerczek says. "A similar finding in New Zealand was observed in sheep grazing pastures high in potassium and low in sodium. Sheep grazing pastures with adequate sodium were unaffected."

Additional research

Grass tetany syndrome was first documented in 1930 in Great Britain, and some of the same observations were made then. "It's like I'm rediscovering the wheel, because everything I'm saying was also seen by the British and Europeans," Swerczek says. "They noticed, also, that salt worked to prevent it, but no one had put it all together."

Swerczek says a comprehensive review of literature on grass tetany substantiates McGraw and his findings. McGraw found that sodium is an important factor and confirms their finding that high levels of potassium and nitrogen in pastures and feedstuffs are likely inducing a sodium deficiency along with a mineral and electrolyte imbalance.

Workers in Holland noted intensively managed fertilized pastures suppressed sodium in forages that were high in potassium and nitrogen. Cows grazing these pastures showed signs of sodium deficiency. Workers in New Zealand noted increased potassium in forage decreased the uptake of sodium in pasture grasses and legumes. After frosts and freezes, potassium increases in pasture forages. "Damaged pastures after frost and freezing decrease the uptake of sodium," he explains. "It appears that magnesium is not affected by frosts and freezes."

In the 1950s researchers in Europe reported when pasture forages were fertilized with high potassium and nitrogen, there was a dramatic incidence of grass tetany. During the same time period, there was great interest in intensive grazing. Consequently, Swerczek says, farmers in Europe heavily fertilized their pastures with potassium and nitrogen. In the spring, researchers observed a remarkable increase of grass tetany. It appeared that when only magnesium was increased in the diet, the cattle with grass tetany did not respond. Interestingly, these workers also considered that cattle may experience a sodium deficiency after pastures were fertilized with potassium and nitrogen.

The British researchers decided to treat affected cattle herds with adequate salt and not with mineral mixes or any additional magnesium. "The results were immediate and the cases of grass tetany for the most part disappeared," he notes. "Not surprisingly, the same results observed by those British workers 60 years earlier were consistent with our findings in affected cattle herds grazing grass pastures with abundant legumes, or pastures recently fertilized with nitrogen."

British workers later confirmed that pasture forages fertilized with high potassium and nitrogen did indeed suppress the uptake of sodium. They also observed an immediate increase in milk production in cattle that were not fed additional magnesium but were given adequate sodium. They recommended to dairymen whose cattle were affected with grass tetany to first change their fertilizer program before adding additional magnesium to pastures and to the diet.

"Grass tetany syndrome should be called nitrate toxicity/salt deficiency leading to low magnesium and low calcium," he says. "When I went through all the literature, worldwide, I never found a single article where researchers were able to experimentally produce grass tetany — except when they elevated the nitrates."

Grass tetany occurs frequently in the eastern half of the U.S. and some other regions because of frequently changing weather conditions. Grass grows for a while during winter, and then weather turns cold again. Because Missouri has the same problems, he wrote to professor Dale Blevins at the University of Missouri and suggested Blevins try to figure out what might be going on with this condition.

When the next catastrophic weather episode occurred in 2007, with a similar change, Blevins had his graduate students analyze the grass — mostly fast-growing tall fescue — to see

what changes occurred during the frost. He wrote an article linking salt deficiency and grass tetany.

Blevins stated the outbreak of grass tetany that followed the cold weather in April 2007 was not a result of low dietary magnesium but rather impaired magnesium absorption by the grazing animals. Since magnesium absorption from the rumen is dependent upon sodium, the sodium deficiency could be the most damaging consequence of a spring freeze.

Blevins' paper also mentioned that rapidly growing, lush tall fescue in early spring is often higher in nitrogen and lower in sodium than during the rest of the growing season and that these factors may have a strong influence on plant magnesium uptake and animal absorption.

"The reason sodium level goes so low is that nitrate level rises dramatically, along with the potassium," Swerczek says. "So Blevins confirmed what I had been trying to tell people for the past dozen years or so. Blevins stated that sodium is very important and cattlemen should consider using salt to help prevent grass tetany."

Then in 2016, livestock nutritionist and forage specialist Woody Lane, Ph.D., Lane Livestock Services, referenced Swerczek's earlier findings regarding the prevention of grass tetany with adequate sodium and not high levels of magnesium. Lane, Roseburg, Ore., stated that high potassium levels in the soil can reduce magnesium uptake by plants and can also reduce magnesium absorption by the animal — fewer magnesium atoms cross into the blood from the digestive tract.

When he first heard about Swerczek's intriguing theory that the syndrome of magnesium tetany was somehow related to the amount of salt in the diet, it sounded strange to him and to other nutritionists because there is a lot of skepticism. Lane says he remained skeptical until he carefully reviewed the scientific literature and found that scientists in Europe have conducted laboratory experiments on the effects of salt and developed sound physiological models to support this theory. Lane's conclusion is that salt is cheap, and he recommended during the tetany season, producers should check the trace mineral mixture they are using, making sure it contains enough salt and that the cattle are actually consuming the salt-mineral mix.

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Dangers in limiting salt

Swerczek points out that for the past few decades, the livestock industry has limited the amount of salt in mineral mixes to encourage animals to consume more minerals — which they do in an attempt to get the salt they need. This lack of salt has led to overconsumption of minerals, which can be toxic if fed in excessive amounts.

Not only has this restriction of sodium led to an increase in incidence of grass tetany, milk fever, downer cow syndrome, acute bloat, and vaginal and rectal prolapses, but it has also created problems caused by the animals' overconsumption of minerals in their attempt to obtain salt. Overfeeding of magnesium, for instance, may result in decreased milk production in dairy cows, severe reduction in weight gains for beef calves and other signs of mineral imbalance and toxicity.

"Even though grass tetany syndrome is causing multi-millions of dollars of losses worldwide, these losses pale in comparison to the number of losses that are occurring in attempts to prevent the syndrome," Swerczek says. "The overfeeding of magnesium and other minerals, and the lack of salt, is causing massive losses due to a multitude of other opportunistic diseases of all classes of herbivores." HW

Symptoms of grass tetany

Early signs of grass tetany in affected cattle include muscle spasms and convulsions, but the first thing noticed may be restlessness. The cow may leave the herd or stop eating. She may become more excitable or more aggressive than normal. Alert ears, face and ears twitching, muscle twitches in the flanks, and wide-eyed staring are early signs, along with head and neck tremors, frequent urination, getting up and down repeatedly, and high stepping with the front legs.

Rapid eye movements, rapid and snapping retraction of the third eyelid membrane, drooling and excessive chewing are also common signs. The cow is alert, easily excited and may charge at anyone or anything that approaches her. This belligerent change in attitude is sometimes mistaken for rabies.

The animal may be uncoordinated and staggering and collapse when she gets excited. Stress may bring on more symptoms. Soon she will go down and can't get up. At this stage she may lie flat on her side with front legs paddling. She may thrash or throw her head back, drooling and breathing hard, and then lapse into a coma. Death is usually the result of respiratory failure during a seizure after she is on the ground. Often the symptoms appear so suddenly there is no chance to see the animal acting strangely. It is critical to keep a close eye on livestock/on cattle during seasons when grass tetany is common. HW