



Beef Briefs

The Latest Information on Beef Cattle Nutrition



Stressed About Corn? It's Stressed Too

By: Laura Martin, M. Sc., Nutritionist

Soil nitrogen is taken up by plants through the roots and transported to the leaves where it is used to make proteins. In corn plants, under normal weather conditions, sunny days promote the turn-over of this nitrogen into plant protein, which results in a good quality crop. However, drought, excessive soil nitrogen, and frost or hail damaged plants can lead to a build-up of nitrates in the stems and leaves of small grain forages and corn plants. High levels of nitrates can be toxic to animals and when ensiled can produce gases that are toxic to humans. Growers should be aware of the potential problems that can occur when feeding high nitrate forages.

There are certain factors that impact nitrate accumulation in forages. The more nitrogen in the soil, and the more available that nitrogen is, the more likely the plant is to absorb too much. Measuring how much of the soil nitrogen is available to the plant is not easy. Growers using manure sources for fertilizer should take extra care to not put too much on and cause an overload of nitrates. Weather has a big impact on nitrate accumulation in plants. Drought conditions, especially droughts following early rain and good plant growth, which hit during pollination, are associated with higher nitrate levels in plants than a sustained drought. Nitrates are water soluble and are taken up readily by plants after a drought-ending rain. It is recommended that harvesting wait at least 5 days after a rain to give these nitrates a chance to be turned into proteins. Frost and hail damage



can also lead to nitrate accumulation as the damaged leaves cannot convert the nitrates into proteins quickly enough. If the nitrates cannot be made into proteins they "back-up" in the stems and roots resulting in the lower, older parts of the plants containing more nitrates than the leaves and grain.

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69819 London Road, RR #1, Centralia, Ontario, Canada, N0M 1K0

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Feeding these high nitrate forages can lead to health issues in ruminants. Nitrates are actually not toxic to animals, and in ruminants are quickly converted into nitrites by the rumen microbes. These nitrites are then turned into ammonia which is either further processed into protein by the rumen microbes or is absorbed into the blood and excreted in the urine. Where problems can occur is when ruminants are given sudden access to high levels of nitrates and it overloads this pathway. The nitrates are still turned into nitrites but the conversion to ammonia is not fast enough to keep up. Both nitrates and nitrites are absorbed into the blood and this is when toxicity can occur.

Nitrites are ten times more toxic to ruminants than nitrate. Nitrite binds to the blood preventing oxygen from getting to the animal's tissues. When enough blood is bound up the animal suffers from oxygen starvation. Some symptoms of acute nitrate poisoning are decreased appetite, labored breathing, frequent urination, blue-grey mucous membranes, excess saliva or tear production, tremors and weakness, staggered gait and blindness. In most acute nitrate poisoning animals are found dead before any symptoms can be observed. In chronic cases of nitrate poisoning, where animals are exposed to elevated levels of nitrates for extended periods of time, the only warning of a problem may be reduced weight gain or late stage abortions.

There are many different ways to help harvest and manage the feeding of high nitrate forages:

- Test the soil for nitrogen levels as a guide to how much nitrogen should be put on the crop – avoid over-applying nitrogen
- Harvest crops on a warm, sunny afternoon as nitrate levels are lowest under these conditions
- Wait at least 5 days after a drought-ending rain to give the nitrates a chance to be converted to protein
- The highest concentration of nitrates will be in the lower stalks so raise the cutter bar to 10-12 inches and leave more stalks in the field. Research shows leaving 6-8 inches of stubble instead of 2-4 inches can reduce

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nitrate levels by 20%

- Ensure weeds in the fields are mature and past the flowering stage as they can accumulate toxic levels of nitrate as well
- Don't graze or feed chopped forages that have been drought stressed
- Ensiling these crops can decrease the nitrate levels by 30-50%
- Ensure proper fermentation
 - corn silage crops with little grain will pack more like a grass silage
 - use a silage preservative to help with the fermentation process
 - wait 3 weeks for proper fermentation before feeding out
- Sample feeds that you suspect of high nitrates. Wait until fermentation is finished before sampling. Samples should be kept frozen and taken to the lab as soon as possible
- Check nitrates in your water supply as high nitrates in the water could compound the problem
- Ruminants can adapt to higher nitrate levels if problem forages are introduced slowly over a 2-3 week period
- Let silage air out before feeding it. If cows cough when fed silage it may be a good idea to get the silage down a day ahead of feeding it
- Dilute high nitrate forages or eliminate feeding them if animals are affected. Nitrates don't normally accumulate in grains so feeding a high concentrate diet is a low risk for nitrate toxicity
- Limit the amount of total urea in the ration. Non-protein nitrogen should not be supplemented with drought stressed corn
- Consult your veterinarian promptly if animals are affected or you notice symptoms
- When feeding high nitrate forages, limit intakes as per Table 1:

Table 1: Guidelines for Nitrate Levels in Forages for Cattle

NITRATE ION %	NITRATE NITROGEN ppm	RECOMMEND
0.0 - 0.44	<1000	Safe to feed under all conditions
0.44 - 0.66	1000 - 1500	Safe to feed non pregnant animals, limit feed use in pregnant animals to 50% of total ration on DM basis
0.66 - 0.88	1500 - 2000	Safely fed if limited to <50% total DM ration
0.88 - 1.54	2000 - 3000	Limit feeds to 30-40% of total DM in ration (feed over 2000 ppm nitrate nitrogen should not be fed to pregnant animals)
1.54 - 1.76	3500 - 4000	Limit feeds to 25% of DM in ration - do not feed pregnant animals
Over 1.76	>4000	Potentially toxic do not feed

Pioneer Forage Manual; A Nutritional Guide; Pioneer Hi Bred International Inc. Des Moines Iowa 1995

BE CAREFUL, WATCH SILO GAS

Although ensiling these high nitrate forages can help in reducing the nitrate load it also comes with its own challenges. As silages are fermented they produce several kinds of gases, the most dangerous of these is Nitrogen Dioxide. This gas is a health hazard to both livestock and humans and can kill quickly. As the green plant material is fermented, oxygen is used up and the nitrates in the plant are released as nitric oxide. This odourless, non-lethal gas escapes quickly from the silage as it is heavier than air. It quickly combines with oxygen in the air to form toxic nitrogen dioxide. This toxic gas can form whenever silage is made not just when there is a nitrate problem.

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Nitrogen dioxide can be recognized by its yellowish-brown colour and its bleach-like smell. This gas will stain silage, wood or any other material it touches the same yellowish-brown colour. It is heavier than air so it may layer on top of the silage, or may settle down through the chute or drain at the base of the silo. Nitrogen dioxide can collect in silo rooms or near the ground around bunker silos. Dead rodents in or around the silo or silo room are a warning sign that toxic gas might be present.

Being alert to the problem will go a long way to minimizing the dangers of nitrogen dioxide. The first 12-60 hours after the silo is filled poses the greatest risk. Stay out of or away from silos immediately after filling and the following day. However, extra caution should be taken around silos and bunkers for up to 3 weeks, or until fermentation is complete. Run the blower for 15-20 minutes before entering upright silos and be careful around the vents in silo bags. Be aware of your surroundings – check for yellowish-brown fumes or bleach-like odours near the silo. Small amounts of nitrogen dioxide may not be obvious to the eye or nose but can still be dangerous. Always have a person nearby when entering the silo so that help can be summoned if needed. Consult your doctor immediately if you think you have been exposed to silo gas. Treatment can help prevent lung damage and keep pneumonia from developing later.

While we can always hope for a perfect growing season more often than not we end up with one challenge or another. From no rain to flash floods, no sun to desert-like conditions the key to managing any situation is to be aware of the problem and the steps that can be taken to deal with it. This article focused on corn silage but high nitrates can also occur in small grain forages. If you are concerned about the nitrate levels in your forages consult with your nutritionist or veterinarian and put a plan in place for how you might deal with it at harvest and feed out. Be careful when ensiling forages and make sure everyone on the farm is aware of the dangers of silo gas.



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