



Potential for High Nitrate Levels in Drought-Stressed Corn Silage

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Introduction

As growers consider their options for salvaging drought-damaged corn, the natural option is to harvest the crop for silage. Growers should be aware that elevated nitrate levels in drought-stressed corn silage can result in harm to humans and livestock. Nitrates can accumulate in corn during unfavorable conditions when growth is slow and nitrates are plentiful. High levels of nitrates in corn silage can be toxic to animals. Symptoms of nitrate poisoning include labored breathing, loss of weight, and lack of appetite. General recommendations are that silages with less than 1000 ppm nitrate-N are safe to feed. Silages with levels of up to 4000 ppm should be diluted with other feed to achieve 1000 ppm or less concentration in the ration.

Another problem with nitrate accumulation in drought-stressed corn is silo gas. Silo gas is common in all silages but more so in forage crops such as corn and sorghum that accumulate nitrates from exposure to stress situations including drought, hail, frost, cloudy weather and fertility imbalances. Nitrates are responsible for lethal silo gas when they combine with organic silage acids to form nitrous oxide. The nitrous oxide decomposes to water and a mixture of nitrogen oxides including nitrogen oxide, dioxide and trioxide. These forms of nitrogen are volatilized as a brownish gas in the atmosphere. This gas is heavier than air and very lethal to humans and livestock.

Factors that Affect Nitrate Accumulation in Silage

Nitrogen Availability – Nitrogen fertilizer, manure, or legumes are all sources of nitrogen for corn. The more nitrogen that was available from these sources the greater the likelihood of nitrate accumulation in corn and the greater the potential for high nitrate levels in corn silage. Because it is difficult to determine how much nitrogen is available to a crop, growers using manure sources as fertilizer for corn should be especially concerned about possible nitrate problems.

Type of Drought - Long, sustained droughts are not as likely to cause accumulation of nitrates in corn as are brief, intense droughts. Drought that occurs early results in less nitrogen uptake by the plant and less problem with nitrate levels in the silage. The worst kind of drought situation is where there is good early rain and growth by the corn plant followed by dry weather during pollination that results in little or no kernel development.

Because nitrate is water soluble and highly mobile nitrate accumulation is highest after a drought-ending rain. This occurs because the rain moves the nitrates in the soil into the root where they are taken up by the plant. It usually takes 3-4 days before these nitrates are converted by the plant into proteins. Therefore, harvesting corn silage following a drought-ending rain should be delayed until nitrate levels in the plant recede.

Cloudy Weather – Cloudy days often cause elevated nitrate levels because the enzyme that converts nitrates to protein is less active during periods of reduced sunlight.

Nutrient Deficiencies – Deficiencies of nutrients such as phosphorus, potassium, and manganese increase the concentrations of nitrate. In this situation, root uptake of nitrates continues, but growth is limited causing nitrates to accumulate.

Plant Age and Plant Part – Nitrates accumulate most in the lower, older parts of the plant. The stem and roots have higher concentrations than the leaves or ears. A proven method for reducing nitrate levels in corn silage is to chop corn at a greater height above the ground. Leaving 6 to 8" stubble instead of 2 to 4" stubble can reduce nitrate levels by 20%.



Assessing the Problem

High nitrate levels will probably not be a problem for growers who used nominal rates of nitrogen fertilizer and who have experienced continuous drought since its onset in mid May. Growers who use manure and those who have had intermittent showers that resulted in more forage growth but little or no grain should be cautious about salvaging corn as corn silage. In particular, growers should be very cautious about salvaging corn as “green chop” (silage feed immediately after it is cut). Ensiling corn that is suspected of having high nitrate levels is preferred to green chopping since the fermentation process will decrease nitrate levels by about 50%. It will be important for growers that green chop or growers who apply manure to take a nitrate test before feeding the material to livestock. **WHEN IN DOUBT, HAVE THE FORAGE ANALYZED BEFORE FEEDING.** Even forage with nitrate levels over 1000 ppm nitrate-N can be fed if diluted with other feedstuffs, but it is important to know what you have before you feed it.

Ways to Reduce Nitrates in Corn Silage

1. Do not feed until the fermentation process is complete. Fermentation will reduce nitrate levels by 30 to 50%.
2. Avoid situations where manure and/or fertilizer results in very high rates of nitrogen applied on a droughty soil.
3. Minimize plant stresses due to nutrient deficiencies.
4. Harvest on bright sunny days.
5. Do NOT harvest for at least 3 days following a soaking rain that comes after a period of dry weather.
6. Raise the cutter to leave at least 6” of stubble.
7. Dilute high nitrate corn silage with feed grains or hay.

Resources

Cited Publications: Roth, G. and D. Undersander. 1995. Corn silage production, management, and feeding. ASA, CSSA, SSSA special publication. Madison, WI. pp. 41.

WHERE TO SUBMIT CORN SILAGE SAMPLES FOR NITRATE TESTING: North Carolina Plant Testing Services: For more information consult your regional North Carolina Department of Agriculture agronomist or visit the website at: www.ncagr.com/agronomi/problem.htm