



Nitrate accumulation in drought stressed corn and forages: sampling and testing

Darryl D. Warncke, Department of Crop and Soil Sciences, Michigan State University

In some years, farmers may face salvaging drought stressed corn and forage crops by chopping it for silage or cutting it for hay. When that occurs be aware that feeding of drought stressed corn silage, green-chopped forage or hay to cattle carries the concern of nitrate poisoning.

Conditions favoring nitrate accumulation in plants

Under normal growing condition, nitrate nitrogen taken up by plants is readily converted into amino acids and proteins. Hence, the level of nitrate is not high enough to be toxic. During prolonged periods of moisture stress (drought) and high temperatures or low humidity, nitrate accumulates in plants. The severity of nitrate accumulation in plants is accentuated by heavy nitrogen fertilization prior to the onset of drought. The most crucial period for nitrate accumulation in drought-stressed corn and forages is actually during the first week or two after the drought is broken by significant rain.

The first significant rainfall event to fully moisten the soil stimulates microbial activity in the soil causing a flush of nitrate nitrogen to be released into the soil systems. As a result, the recovering plants take up large amounts of nitrate that they are not able to fully assimilate. This results in accumulation of nitrate in the plants. It may take up to two weeks for the recovering corn or forage crop to fully assimilate the accumulated nitrate and reduce the risk of nitrate toxicity to animals. Hence, to reduce the risk of nitrate poisoning in green chopped corn or forage after new growth begins, wait two weeks before harvesting.

The feeding of high nitrate forage or corn directly, as hay, green chop or as silage is a threat to the health of cattle. Ensiling chopped corn will reduce the nitrate concentration, but to what degree is difficult to predict. Hence, both green chopped or ensiled corn or forages should be tested to determine the nitrate concentration.

Test the forage and corn for nitrate

The soil and Plant Nutrient Lab (SPNL) at Michigan State University is able to determine the nitrate content of various plant materials. Sampling is the key to getting a good representative sample and a meaningful result. Due to field variability in regards to moisture supplying capability, the nitrate concentration in forage or corn vegetation may vary.

Representative samples may be prepared in a couple ways. Prior to cutting or chopping the forage or corn, collect plant samples from 20 locations in the field area of interest. Sampling field areas by degree of drought stress or stage of plant growth provides information about the variability in the field. Chop up this plant material, mix and take out about a gallon of material to be dried. The alternative is to take grab samples off of a load of chopped material. Similarly, for ensiled material collect several grab samples and mix together to form a composite sample. Mix these together thoroughly and take out a one-gallon sample for drying. Dry samples before sending them to the lab. Moist samples may be delivered directly to the lab. After drying, send one to 2 quarts of material to the lab for

analysis. Samples can be sent via your local County Extension Office or directly to the MSU SPNL at A81 Plant & Soil Sciences Building, Michigan State University, East Lansing, MI 48824-1325.

Information to provide

Name, address, telephone number, the county of residence and FAX number for returning the results.

Fee for analysis is \$1,000 per sample. Enclose a check payable to Michigan State University for the appropriate amount.

Interpretation of results

The following table gives recommendations for feeding forages to cattle. Note the difference between NO₃-N and NO₃. Consult your feeding specialist for updated information concerning interpretation of nitrate concentrations in your feed.

Guidelines for feeding forages to cattle based on nitrate nitrogen and nitrate concentrations.

NO ₃ -N	NO ₃	Feeding Recommendations
ppm		
<1000	<4400	Not toxic.
1000 - 2000	4400 - 8800	Limit feed to less than 50 percent of the ration dry matter
2000 - 4000	8800 - 17600	Limit feed to less than 25 percent of the ration dry matter. Don't feed to pregnant cattle.
>4000	> 17,600	Don't feed



MSU is an affirmative-action, equal-opportunity institution. Michigan State University Extension programs and materials are open to all without regard to race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, marital status, or family status. • Issued in furtherance of Extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Tom Coon, Extension Director, Michigan State University, E. Lansing, MI 48824. • This information is for education purposes only. References to commercial products or trade names do not imply endorsement by MSU Extension or bias against those not mentioned.