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## Nitrate and Prussic Acid: How to Obtain a Representative Sample

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If you have drought-stressed crops and still want to use them, there are two options: (1) Bale the crop, or (2) ensile it. In either case, the forage should be evaluated for crop hazards like nitrates or prussic acid (also called hydrocyanic acid, HCN) that are potentially toxic to livestock.

**Nitrates:** Baling will not lower the nitrate levels in a stressed crop once it is cured. In contrast, ensiling generally lowers nitrate levels about 35% once fermentation is complete.

To determine nitrate levels in the drought-stressed plants you need a representative sample for testing. To collect a representative field crop sample, define the sample area, determine a sample height, and note the time of day the sample is obtained.

The environment of the sample area should be fairly uniform. If a field is relatively flat and uniform in soil type, it could be considered a single sample area. A field that differs greatly in topography or soil fertility should be split into separate sample areas.

Nitrate levels vary widely within a plant; therefore, cutting height for both the test sample and the plants to be harvested should be the same because the lower portions of the plant, especially the lower stalk or stem, are highest in nitrates. If you harvest the plant 12 inches above the ground you should also collect the test sample 12 inches above the ground.

Indirectly, time of day affects sampling because you are visually determining if the plants are just moder-

ately stressed or severely stressed enough to cause nitrates to accumulate. It is not easy to determine the severity of drought, especially during midday when plants often wilt even under well-watered conditions if air temperatures are high and relative humidity is low.

The best time to visually determine whether plants are severely stressed is to look at them about a half hour before sunrise. The water status of plants is at its highest level during pre-dawn hours. At this time, severely wilted plants will remain wilted until they die or are watered. Therefore, the best time to collect a sample is near sunrise when you can see if the plants are recovering during the night or are indeed severely wilted or dead.

A suggested method for collecting a representative sample for nitrate testing follows:

1. Determine sample area. Select for uniform topography and soil fertility. If needed, collect additional samples from additional sample areas.
2. Cut 20 representative plants for each sample area. Cut at the harvest cutting height and put them in a paper box or paper seed bag. Fold the stalks or stems if necessary.
3. If possible, complete a "Sample Information Sheet for Feeds, Forages, and Fertilizers" form from your Extension office or off the Web at <http://anserv.sdstate.edu/> Insert the form in the sample paper box or paper seed bag and prepare the sample(s) for shipment.

4. Mail sample to: Analytical Services  
Olson Biochemistry Labs, ASC 133  
South Dakota State University  
Box 2170  
Brookings, SD 57007-1217

Samples sent Monday to Wednesday generally arrive in good shape. Samples sent late in the week often deteriorate after spending the weekend in the post office. If you are in a hurry to get your test results, mail by first class mail or UPS, not parcel post. Do not put wet plant tissue in a plastic bag; it may turn into silage by the time it arrives for testing.

**Prussic acid:** The incidence of HCN levels in plants is dependent on several factors: plant species, environmental stress, soil fertility levels, location in the plant, and time of day. Generally, HCN may be an issue in such species as forage sorghums, grain sorghums, Sundangrass hybrids, Sorghum-sudangrass hybrids, flax, birdsfoot trefoil, white clover, arrow grass, Indiangrass, shattercane, Johnsongrass, and velvet grass. HCN levels may increase in these species following the recovery of the plants from either drought or non-killing frosts.

The toxifying action of prussic acid is almost immediate and death can occur within 15 to 20 minutes. Generally, cattle and sheep are more susceptible to prussic acid poisoning than horses or swine.

Elevated HCN levels are more commonly found where soils have above average levels of available nitrogen.

Typically, HCN levels are highest in the leaves, not the stem, of the younger tillers or shoots that sprout during recovery following a drought or freeze. This is in contrast to nitrate accumulation, where nitrate levels are generally higher in the lower stalks or stems but lower in the upper stalk or stems, including the leaves.

HCN levels in plant tissue generally tend to be low in the early morning, higher at late morning, and highest

at noon to early afternoon. HCN levels then decline in the late afternoon, and are lower in the evening, and lowest between sunset and sunrise. High levels of HCN may persist for 7 to 10 days during the plant's recovery period.

Resist grazing or harvesting any plants until the new regrowth approaches 20 to 24 inches in height. Proper field curing for hay and ensiling for silage will often reduce the incidence of HCN toxicity by 50 to 70%. In both cases the forage must go through a somewhat lengthy process of curing or ensiling to reduce toxicity. Do not cut any suspected forage and immediately feed it to livestock. Improperly cured hay or improperly ensiled silage may still contain toxic levels of HCN.

Again, as with nitrates, there is often a need to estimate the HCN levels in the drought-or freeze stressed plants by collecting a representative sample for testing before the forage is harvested or utilized. A suggested method for collecting a representative sample for prussic acid testing follows:

1. Determine sample area. Select for uniform topography and soil fertility. If needed, collect additional samples from additional sample areas.
2. Cut the lowest 2 to 3 leaves from the youngest tillers or shoots from 20 different plants in each sample area and put them in a paper box or paper seed bag. Fold the stalks or stems if necessary.
3. Same as item 3 for nitrate sampling.
4. Same as item 4 for nitrate sampling.

Additional references regarding nitrate and prussic acid toxicity:

1. K.M. Cassel, KM and LR Vough. 2002. Harvesting and feeding drought-stressed corn, South Dakota Cooperative Extension Service, Extension Extra EXEX4017.
2. Vough, LR and KM Cassel. 2002. Causes and prevention: Prussic acid poisoning of livestock. South Dakota Cooperative Extension Service, Extension Extra EXEX4016.

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