COOPERATIVE EXTENSION UNIVERSITY OF CALIFORNIA ENVIRONMENTAL TOXICOLOGY NEWSLETTER

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TOXIC PLANTS

I. Cyanide and Nitrate Cyanide

Cyanide (Prussic Acid) poisoning may occur in domestic animals when they ingest plants which contain large quantities of cyanogenetic glycosides. Cyanogenetic glycosides are sugar complexes in which the cyanide molecule is chemically tied up so that it cannot exert a toxic effect. There are two basic ways in which the cyanide in the cyanogenetic glycosides can be released and cause toxicity.

1. Damage to the plant cells may release plant enzymes which cause the release of cyanide from the glycoside complex. Weather conditions such as drought and frost can initiate this process.
2. The action of enzymes in the digestive system of an animal species. Ruminants are particularly susceptible to this.

Plants which have the potential to cause cyanide poisoning in domestic animals are as follows: Sorghum species, white clover, arrow grass, corn, flax, lima beans, leaves and pits of Prunus species (cherries, apricots, peaches) and Apple seeds. The clinical signs of cyanide intoxication in domestic animals include excitement, muscle tremor, rapid labored breathing, collapse, convulsions, and death. A simple reliable field test is available which will detect the presence of toxic quantities of cyanogenetic glycosides in plants.

Rapid Field Test for the Detection of Cyanide

1. To a large test tube or a small flask, add 1 to 5 gm. of finely chopped fresh plant material or rumen contents. If the material is dry or you want to check seeds, macerate it with a little water.
2. Add 4 to 12 drops of chloroform.
3. Prepare the picrate test strip by putting a drop of the picrate solution on a strip of filter paper. Close the container and hang the picrate strip so that it does not touch the sides or the material at the bottom of the tube.
4. Warm the container to 30 to 37C. Let reaction continue about three hours. The test is positive if the strip turns various shades of red. The appearance of a dark brick red color is significant. Milder color changes that occur are of little concern.
5. A negative test suggests the absence of a cyanogenetic glycoside, or that a hydrolyzing enzyme was not closely associated with it.

Picric Acid Test Solution

1. Sodium Bicarbonate, 5 gm., and picric acid, 0.5 gm., QS 100 ml. with water. Keep cool in glass-stoppered brown bottle.
2. Try the test using 5-10 apple seeds as a positive control. This will give an idea of the type of color change that is significant.

Nitrate

Nitrate ion is a normal constituent of plants. Under certain conditions abnormal accumulation of nitrates may occur and cause toxicity in domestic animals. Nitrate levels in plants are highest in the vegetative tissues (such as leaves and stalks) and is usually greatest in the stalk. Two environmental conditions which predispose to the accumulation of nitrates in plants are drought and low light levels. Management factors such as fertilization and herbicide treatment with phenoxy acid herbicides will also increase accumulation of nitrates in plants. Plants which have the potential to cause nitrate poisoning are: pigweed, lambs quarters, sweet clover, dock, smart weed, Johnson grass, Sudan grass, and many others.

Nitrate toxicity is mainly a problem in herbivores, and especially ruminants. This is because the bacteria normally present in the rumen can reduce the nitrate ion to nitrite ion which is responsible for the toxic effect (methemoglobinemia). Clinical signs of labored breathing, weak rapid pulse, muscle tremors, weakness and intolerance to exercise are seen. The mucous membranes (inner surface of the eyelids, gums, inner surface of the lips) may appear dark instead of a normal bright pink. Acute poisoning may occur when the level of nitrates in feed (dry matter basis) exceeds 1%. Because fetal hemoglobin is more sensitive to the effects of nitrite, abortions can be caused by levels of nitrate which do not elicit overt signs of toxicity in the dam. Elevated levels of nitrate in forage were responsible for a number of equine abortions in Kentucky during the Spring of 1980. A rapid simple qualitative field test is available to test forages for toxic levels of nitrate.

Rapid Field Test for the Presence of Toxic Levels of Nitrate Ion Diphenylamine stock solution is prepared by dissolving 0.5 gm. of Diphenylamine in 20 ml. of water. Sulfuric acid is added to bring the volume to 100 ml. Equal parts of this stock solution are mixed with 80% sulfuric acid. Test suspect material by dropping one drop of reagent on the cut surface of the plant (stem joints are a good place). A color change to bright blue indicates a nitrate level which can cause toxicity. The solution is caustic so avoid skin contact with it.

Both of these tests are easily performed and very reliable if performed according to the directions. They have been used most often after the fact to establish a diagnosis of nitrate or cyanide toxicity in animals. I think that they also could be used to help prevent such toxicities by testing suspect samples when environmental conditions make it seem likely that there might be problems.

Cooperative Extension County offices can receive one each of these test kits by writing to me. Jim Quick of the Davis Soil, Water, and Plant Analysis Laboratory has generously consented to construct these kits for field use by Cooperative Extension personnel. If you wish to have these kits in your County, please write to me; I will be handling their distribution.

The test procedures listed in this newsletter are modifications of a method published in Clinical and Diagnostic Veterinary Toxicology, Second edition, edited by G.A. vanGelder, Kendall/Hunt Publishing Company, Iowa, 1976.

Correction: In the last newsletter on Malathion, I stated that the CDFA and the Department of Health Services "released a joint report." This is incorrect. The reports were released separately. The Summary and Recommendations that were reprinted in the newsletter were taken from the DHS report.

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