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Prussic Acid

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Hydrocyanic acid (HCN) or prussic acid is generally found in stressed plants and is formed by enzymatic action on compounds called the cyanogenetic glucosides (dhurrin) when growth is adversely affected. In healthy plants, the cells containing the glucosides and enzymes (emulsin) apparently keep these constituents separated. When growth is depressed by adverse environmental conditions, such as moisture stress or frost, the enzymatic action may take place producing prussic acid.

The breakdown of plant cells by crushing or bacterial action in the rumen may also result in prussic acid formation. When dhurrin is broken down in the rumen by enzymatic action, the cyanide is absorbed and combines with hemoglobin in the bloodstream. This affects the electron transport system at the cellular level and prevents the cells from receiving oxygen from the blood. The blood is able to transport oxygen from the lungs, but the body tissue can't take it up. Suffocation results. One symptom of prussic acid poisoning is bright red blood, since it is saturated with trapped oxygen.

Susceptible Plants

The amount of HCN found in plant tissue varies among species. Of all the plants grown in Arkansas, those belonging to the sorghum category are most likely to contain potentially toxic levels. Grain sorghum contains the most, followed by johnsongrass, sorghum-sudan hybrids and then pure sudangrass. However, johnsongrass may be the plant of most concern since it grows wild throughout the state and infests many areas that are grazed. Close grazing for several years usually eliminates johnsongrass from pastures. Millet is free of the toxin. HCN may be produced by a few other plant species. Wild cherry trees can produce toxic levels, and HCN poisoning occurs most often when animals consume wilted leaves after trees have been damaged by storms or pruning.

The amount of HCN is higher in young plants than in older ones, and the HCN content of leaves is higher than that of stems. Upper leaves contain more than the lower ones. Prussic acid concentration decreases as the plants become taller and more mature. Usually, sorghum-type plants 18 to 24 inches tall are less likely to contain high concentrations of the toxin. Immature plants and regrowth following haying or grazing contain the highest levels. Drought and frost are closely associated with high levels of HCN. Plants growing under stressful conditions and those that have received more than 75 pounds of nitrogen per acre in one application may contain more toxins.

Plants have more potential for producing HCN if the soil is high in nitrogen and deficient in phosphate and potassium. An increase in HCN may result in fields treated with 2,4-D.

Symptoms of Poisoning

Symptoms of prussic acid poisoning include anxiety, progressive weakness and labored breathing, and death may follow when lethal amounts of HCN are

consumed. However, the dead animals may be found without visible symptoms of poisoning. Animals may also show increased rate of respiration, increased pulse rate, gasping, muscular twitching and convulsions. Death often occurs rapidly in affected animals.

Susceptible Animals

Ruminant animals (cattle, sheep and goats) appear to be the most susceptible to prussic acid poisoning. Reports of poisoning in swine and horses are rare.

Although HCN is not often a problem in horses, feeding sorghum-type forage may produce a malady known as **cystitis syndrome**. The exact cause of the disease is not known. Affected horses exhibit position incoordination, urine dribbling and abortion in pregnant mares. Horses should not be grazed on johnsongrass, sudan or sorghum-sudan species.

Relationship to Nitrate Poisoning

Under certain stressful conditions (especially prolonged drought or cool, cloudy weather), many annual grasses, including the sorghum-sudan hybrids, may accumulate high levels of nitrates in their stems. There is little or no relationship between prussic acid and nitrate poisoning. However, HCN poisoning is often confused with nitrate poisoning since environmental conditions and animal symptoms of the two disorders are somewhat similar.

Precautions for Using Sorghums or Johnsongrass

- Do not allow animals to graze fields with succulent, young, short growth. Graze only after plants reach a height of 18 to 24 inches.

- Do not graze drought-damaged plants in any form, regardless of height, within four days following a good rain. It is during this period of rapid growth that accumulation of HCN in the young tissue and of nitrates in the stems is most likely to occur.

- Do not graze wilted plants or plants with young regrowth. Do not rely on drought-damaged material as the only source of feed. Keep either dry forage or green chop from other crops available at all times. Uneven growth as a result of drought can best be utilized as silage or hay.

- Do not use frost-damaged sorghum as pasture or green chop during the first seven days after the first killing frost. Delay pasturing for at least seven days or until the frosted material is completely dried out and brown colored. Do not rely on frosted material as the only source of feed. Do not graze at night when frost is likely.

- Do not turn hungry cattle onto a pasture of sorghum, sorghum-sudan hybrid or johnsongrass. Fill them up on hay or other forage first, and begin grazing in the late afternoon.

- An option for using potentially toxic forage is to harvest it as hay or silage. Prussic acid levels decline in stored forages. Well-cured hay is safe to feed, and if forage likely to have high prussic acid is ensiled, it is usually safe to feed three weeks after silo fill.

Animal Treatment

Animals affected by prussic acid poisoning may be treated with a sodium nitrite-sodium thiosulfate combination. It must be injected intravenously and very slowly. The dosage and method of administration are critical. Consult a veterinarian to correctly diagnose prussic acid poisoning and to determine the proper treatment.

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