

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 cyanogenic glucosides (dhurrin) when growth is adversely affected. In healthy plants, the cell containing the glucosides and enzymes (emulsin) apparently keeps 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 the 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. Extensive grazing for several years usually eliminates johnsongrass from pastures. Millet is apparently 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 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 when broadleaf forages or weeds are treated with 2,4-D at rates that stunt crop growth.

Symptoms of Poisoning

Symptoms of prussic acid poisoning include anxiety, progressive weakness and labored breathing, followed by death when lethal

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amounts of HCN are consumed and the enzymatic action takes place. 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 may occur from respiratory paralysis.

Susceptible Animals

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

Although HCN is not often a problem in horses, feeding sorghum-type forage may produce a malady known as “crystitis syndrome.” The exact cause of the disease is not known, but forage from sorghum-type plants has been a constant factor in every outbreak. Affected horses exhibit position incoordination, urine dribbling and abortion in pregnant mares. Horses should not be grazed on sudan or sorghum-sudan species since all treatments for crystitis syndrome have demonstrated little success.

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 harvest or feed 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 an 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. Even when this material is mildly toxic, it can be fed safely to animals receiving some other forage or grain source. Uneven growth of hybrids as a result of drought can best be utilized as silage.
- 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 paper brown colored. Do not rely on frosted material as the only source of feed. The toxin is usually dissipated within 48 hours. 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 first, and begin grazing in the late afternoon.
- Prevent selective grazing of the young regrowth, which may be highly toxic, by rotational grazing of small pastures that may be grazed down to a six-inch stubble within a ten-day period. This will mean cross fencing to provide short-term rotational or strip grazing.
- Silage may contain toxic quantities of HCN, but it usually escapes in gaseous form while being moved and fed. If frosted forage is ensiled, allow fermentation to take place for at least six to eight weeks before feeding.
- The HCN potential of hay decreases during the curing stage and is only dangerous if hay is improperly cured.

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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