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Prussic Acid Poisoning Potential in Frosted Forages

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Abstract
The first few frosts of the fall bring the potential for prussic acid poisoning when feeding forages. Some forage species, primarily sorghums and closely related species, contain cyanogenic glucosides, which are converted quickly to prussic acid in freeze-damaged plant tissue. Historically in Iowa there are very few documented cases of prussic acid poisoning. However, the risk is present, and good management practices are necessary to minimize the risks.

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Prussic Acid Poisoning Potential in Frosted Forages

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The first few frosts of the fall bring the potential for prussic acid poisoning when feeding forages. Some forage species, primarily sorghums and closely related species, contain cyanogenic glucosides, which are converted quickly to prussic acid in freeze-damaged plant tissue. Historically in Iowa there are very few documented cases of prussic acid poisoning. However, the risk is present, and good management practices are necessary to minimize the risks.

Prussic acid, or more precisely, hydrocyanic acid, is a cyanide compound that can kill animals within minutes of ingestion under the right circumstances. Cyanide interferes with the oxygen-carrying function in the blood, causing animals to die of asphyxiation. Symptoms include difficult breathing, excess salivation, staggering, convulsions and collapse. Affected animals will have bright cherry red mucous membranes from the cyanide. Ruminants are more susceptible than horses or swine because they consume large amounts of forage quickly and the rumen bacteria contribute to the release of the cyanide from consumed plant tissue.

Sudangrass varieties are low to intermediate in cyanide poisoning potential, sorghum-sudangrass hybrids and forage sorghums are intermediate to high, and grain sorghum has high to very high poisoning potential. Pearl millet and foxtail millet have very low levels of cyanogenic glucosides. A few other plants also can produce prussic acid, including cherry trees.

Prussic acid does not form in sorghum and sudangrass plants until the leaf tissue is ruptured, as with grazing or chopping. Young, rapidly growing plants will have the highest levels of prussic acid. The cyanide-producing compounds are more concentrated in young leaves. Minimum plant heights of 18 inches are recommended, to avoid using risky, young leaf tissue. Plants growing under high nitrogen levels are more likely to have even higher cyanide potential.

Frost and freezing can cause a rapid change in prussic acid risk in plants of any age or size. With frost, forage tissues rupture, and cyanide gasses form. The cyanide gas can be present in dangerously high concentrations within a short time, and remain in the frosted leaves for several days. Because cyanide is a gas, it gradually dissipates as the frosted/frozen tissues dry. Thus, risks are highest when grazing frosted sorghums and sudangrasses that are still green. New growth of sorghum species following frost can be dangerously high in cyanide due to its young stage of growth. Prussic acid content decreases dramatically during the hay drying process and during ensiling. Frosted foliage contains very little prussic acid after it is completely dry. Sorghum and sudangrass forage that has undergone silage fermentation is generally safe to feed.

Precautions to take to limit risk

When grazing or greenchopping species with prussic acid potential this fall, follow these guidelines:

- Do not graze on nights when frost is likely. High levels of the toxic compounds are produced within hours after a frost.
- Immediately after frost, remove the animals until the grass has dried thoroughly. Generally, the forage will be safe to feed after drying five to six days.
- Do not graze wilted plants or plants with young tillers or new regrowth. If new shoots develop after a frost they will have high poisoning potential, sudangrass should not be grazed until the new growth is at least 18 to 20 inches (24 to 30 inches for sorghum-sudangrass).

  Best management is to allow the final, killing freeze to kill the crop, and then wait five to six days before grazing. Other practical managements may be to harvest as hay or silage since. In most cases, adequate growth for safe grazing cannot be obtained after a later, killing freeze occurs.

- Don't allow hungry or stressed animals to graze young growth of species with prussic acid potential.

  Green-chopping the frost-damaged plants will lower the risk compared with grazing directly, because animals have less ability to selectively graze damaged tissue; however, the forage can still be toxic, so feed with great caution. Feed greenchopped forage within a few hours, and don't leave greenchopped forage in wagons or feed bunks overnight.

When making hay or silage from sorghum species this fall, consider the following:

- Frosted/frozen forage should be safe once baled as dry hay. The forage can be mowed any time after a frost. It is very rare for dry hay to contain toxic levels of prussic acid. If the hay was not properly cured, it should be tested for prussic acid content before feeding.
- Waiting five to seven days after a frost to chop frosted forage for silage will limit prussic acid risks greatly.

  Delay feeding silage for eight weeks after ensiling. If the forage likely contained high HCN levels at time of chopping, hazardous levels of prussic acid might remain and the silage should be analyzed before feeding.

  Other common forages such as alfalfa, clovers and cool-season perennial grasses do NOT produce toxic compounds after a frost and can be fed safely. The only concern is a slightly higher potential for bloat when grazing legumes within a day or two after a killing frost.

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