Preventing Prussic Acid Poisoning

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A significant risk of grazing certain species of drought or frost-damaged forages is hydrocyanic acid poisoning. This is more commonly known as prussic acid or cyanide poisoning. While prussic acid toxicity occurs less frequently than nitrate poisoning, cases are not uncommon in South Carolina. This bulletin will review causes of prussic acid poisoning and offer management strategies to help prevent animal losses.

Forage species of concern
Plants in the sorghum family are susceptible to prussic acid formation and include johnsongrass, sudangrass, sorghum and sorghum-sudan hybrids. Wilted wild cherry leaves can also contain lethal amounts of prussic acid. Unlike sorghums, pearl millet does not produce prussic acid (but does accumulate nitrates) and can be safely grazed following a frost.

Prussic acid formation
Prussic acid or hydrocyanide is formed during water stress or following frost. Under normal growing conditions, these plants produce a nontoxic substance called dhurrin. When plants are injured by frost or wilting, enzymes come into contact with dhurrin and liberate toxic prussic acid or cyanide. Prussic acid is most concentrated in young, leafy tissue which is also the plant part preferentially selected by grazing animals. Therefore, unlike nitrate toxicity, grazing pastures lightly to reduce toxin intake is unlikely to succeed and can actually increase odds of prussic acid poisoning.

Toxic mechanism
Prussic acid is lethal to animals because it interferes with the animal’s ability to generate energy. This ultimately results in death. Simply put, cyanide prevents oxygen transfer from the blood and animals suffocate at the cellular level. Because blood from prussic acid poisoned animals does not release oxygen, venous blood is normally a bright cherry red color when a postmortem examination is performed and helps to distinguish prussic acid from nitrate toxicity in post mortem examinations.

Prussic acid poisoning often occurs extremely rapidly. The time from ingestion of toxic forages to death is usually short with animal losses sometimes occurring within 10 to 15 minutes of grazing toxic pastures. Typical animal symptoms include excessive salivation, rapid breathing, and muscle spasms. Because the tissues cannot receive oxygen, mucous membranes often have a purplish color. Animals are occasionally observed staggering through the pasture before collapse and death. Many external symptoms mimic those of nitrate poisoning and successful treatment is almost impossible because of the rapid progression. Animals must be removed from toxic pastures immediately. Preventative management is the only reliable method to avoid animal losses.
Preventative Management

*Maintain soil fertility.* There are indications that adequate soil phosphorus can decrease the potential for prussic acid formation. Maintaining adequate soil phosphorous and potassium allows efficient formation of cells and utilization of nitrogen. Plants growing in good soil fertility conditions convert nitrogen more effectively which minimizes the risk of both nitrate and prussic acid poisoning. Conversely, heavy nitrogen fertilization (even with a balanced soil fertility program) increases risk of both prussic acid and nitrate poisoning. It is important to soil test fields and follow fertility management recommendations to ensure appropriate nutrients are present for plant growth. Excessive nitrogen applications should be avoided to decrease the probability of toxic nitrate and prussic acid levels.

*Restrict access to dangerous forages during critical time periods.* Do not allow cattle access to susceptible plant species (i.e. Johnsongrass, sorghum x sudan, or sudangrass) immediately following a drought ending rain. Rapidly growing young plant tissue can contain toxic levels of prussic acid for 10-14 days. Frost damaged plants also can contain high levels of prussic acid. Grazing in frosted fields should also be avoided for at least a week. Use extreme caution when grazing frosted fields as stands are often not completely killed. New tillers or surviving tillers following a frost can be highly toxic and should also be avoided for 1-2 weeks.

Remove wild cherry trees from pastures or minimize animal exposure to them by fencing off wooded areas. Examine areas containing cherry trees immediately following storms; particularly when forage is in short supply as animals will be more likely to consume the leaves.

*Monitor stage of growth and manage grazing.* Use caution when rotating small groups of animals into new paddocks as there is opportunity for selective grazing. **Young, leafy portions of high risk plants** are the most toxic portions of the plant. Stocking pastures lightly may increase prussic acid risk (but decreases risk of nitrate toxicity) as animals often preferentially select these plant portions. Mob stocking in a rotational grazing system will minimize selection opportunities and force animals to eat a combination of young and old plant tissue.

*Harvest forage either as cured hay or ensilage.* Cured hay harvested from frost or drought stressed pastures will not contain toxic amounts of prussic acid as the concentration will deteriorate by the time of baling. Silage should also be safe for feeding after the ensiling process is complete (approximately 3 weeks). Remember, nitrate toxicity is different than prussic acid poisoning. Unlike prussic acid, toxic levels of nitrate will remain in hay and do not diminish over time. Testing for nitrates is critical to ensure safe hay feeding, especially following drought conditions. For more information regarding nitrate toxicity, please see Clemson Extension Forage Leaflet #13 “Defining and Managing Nitrates in Forages”.

**Summary**
Prussic acid poisoning can be a serious problem if a susceptible plant species is grazed under the appropriate conditions. To minimize issues, select forage species that are not prone to release prussic acid. Maintain good soil fertility and apply adequate, but not excessive, nitrogen. Avoid grazing susceptible species for 10-14 days immediately following a drought ending rain or killing frost and when possible utilize rotational stocking to minimize selection of young plant tissue. If poisoning is suspected, immediately remove animals from pasture and contact a veterinarian.