Cyanide Poisoning in Ruminants

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The primary cause of cyanide poisoning in ruminants is the ingestion of plants containing cyanide-producing compounds called cyanogenic glycosides. These cyanogenic glycosides occur in living plant cells and can be converted to cyanide by enzymes present in the plant when plant cells are crushed, chewed, wilted, frozen or otherwise ruptured. Ruminants are very susceptible to cyanide poisoning because the rumen environment is mildly acidic, usually has ample water content, and the microflora can rapidly convert cyanogenic glyocosides in plants to free cyanide gas. "Prussic acid poisoning" is older terminology for cyanide poisoning. Hydrogen cyanide was first isolated from a blue dye (Prussian blue) and because of its acidic nature, it became known by the common name "prussic acid".

The cyanogenic potential of plants is affected by species and variety, weather, soil fertility and stage of plant growth. Cyanide poisoning of livestock is commonly associated with johnsongrass, sorghum-sudangrass, and other forage sorghums. Choke-cherry or wild cherry, elderberry, and arrow grass are less frequent causes. Young plants, new shoots, and regrowth of plants after cutting often contain the highest levels of cyanogenic glycosides. Application of herbicides such as 2,4-D can increase the cyanogenic potential of plants. There are wide differences among plant varieties. Some of the sudangrasses, such as Piper, are low in cyanide. Drying plants decreases the cyanogenic potential over time. Ensiling plants will significantly reduce the cyanogenic glycoside content.

Cyanide is one of the most potent toxins in nature. As ruminants consume plant materials containing cyanogenic glycosides, hydrogen cyanide is liberated in the rumen, rapidly absorbed into the bloodstream and prevents hemoglobin from releasing its oxygen to the tissues. If large quantities of cyanide are absorbed rapidly enough, the body's detoxification mechanisms are overwhelmed and the animal soon dies. Affected animals rarely survive more than 1-2 hours after consuming lethal quantities of cyanogenic plants and usually die within 5-15 minutes of developing clinical signs of poisoning. Signs may include rapid labored breathing, irregular pulse, frothing at the mouth, dilated pupils, muscle tremors, and staggering. The mucous membranes are bright red in color due to oxygen saturation of the hemoglobin.

The risk from potentially dangerous forages may be reduced by following these management practices:

1. Graze sorghum or sorghum cross plants only when they are at least 18-24 inches tall. Young rapidly growing plants or regrowth have the highest concentrations of cyanogenic glycosides, especially in the newest leaves and tender tips. Do not graze plants with young tillers.

2. Do not graze plants during drought periods when growth is severely reduced or the plant is wilted or twisted. Drought increases the chance for cyanide because slowed growth and the inability of the plant to mature favors the formation of cyanogenic compounds in the leaves. Do not graze sorghums after drought until growth has resumed for 4-5 days after rainfall.

3. Do not graze potentially hazardous forages when frost is likely (including at night). Frost allows conversion to hydrogen cyanide within the plant. Do not graze for two weeks after a non-killing (>28 degrees) frost. It is best not to allow ruminants to graze after a light frost as this is an extremely dangerous time and it may be several weeks before the cyanide potential subsides. Do not graze after a killing frost until plant material is completely dry and brown (the toxin is usually dissipated within 72 hours).

4. Do not allow access to wild cherry leaves. After storms or before turnout to a new pasture, always check for and remove fallen cherry tree limbs.

5. If high cyanide is suspected in forages, do not feed as green chop. If cut for hay, allow the cyanide to volatilize before baling. Allow slow and thorough drying because toxicity can be retained in cool or moist weather. Delay feeding silage 6 to 8 weeks following ensiling.

6. Forage species and varieties may be selected for low cyanide potential.

Cyanide is rapidly lost from animal tissues unless collected within a few hours of death and promptly frozen. Liver, muscle (ventricular myocardium preferred), whole blood, and rumen contents should be collected and frozen in air-tight containers before shipment to a laboratory capable of cyanide analysis. Perhaps most important in the diagnosis of cyanide poisoning is to identify plants in the area that the animals had access to determine if they are likely to contain cyanogenic glycosides. Cyanide concentration determinations in suspect plants can be performed if samples are frozen immediately or sent on ice overnight to the veterinary diagnostic laboratory. Treatment can be attempted if affected animals are discovered quickly, but often animals are just found dead. Contact a veterinarian immediately if cyanide poisoning is suspected.

If you have questions concerning testing for cyanide in forages, call your county Agricultural Extension Agent for further information. A field test is now available to screen forages for potentially toxic levels of cyanide.