FORAGES FOR ALL SEASONS

Managing forages to minimize prussic acid poisoning

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Damage to sorghum plants such as freezing, trampling, and chewing causes plant compounds to mix and release hydrogen cyanide.

Although it is not as common as nitrate poisoning in Wyoming, livestock producers need to be aware of conditions in which prussic acid can be toxic to livestock. Conditions that produce high nitrate can also increase prussic acid toxicity.

Prussic acid or hydrogen cyanide (HCN) poisoning occurs when the enzyme emulsin, which is found primarily in plant tissue of the sorghum family, interacts with dhurrin, also found in these crops. Damage to plants such as freezing, trampling, and chewing causes these two plant compounds to mix and release hydrogen cyanide. The cyanide in the consumed forage is absorbed into the bloodstream, preventing hemoglobin from transferring oxygen and resulting in death from asphyxiation.

Species. Among sorghums, grain and forage sorghums are most likely and sudangrass least likely to have high prussic acid potential. Most sorghum-sudangrass hybrids now have low prussic acid potential, like the sudangrass parent, although varieties can vary. It is worth inquiring about when purchasing seed. A few weedy sorghums also have prussic acid potential, but they are not common in Wyoming. There are no reports of HCN poisoning in foxtail (hay) millet.

Plant parts. Leaf blades are generally highest in nitrate, followed by leaf sheaths, stems, and heads. Upper leaves have a greater amount of nitrate than lower leaves. Tillers or "suckers" have a higher potential for toxicity because they are mostly leaf tissue.

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Sorghum

Plant maturity. As plants mature, stems or stalks make up more of the total forage; however, if livestock are allowed to selectively graze, the hazard declines little with maturity. Overall, the prussic acid potential seems to decline after the boot stage.

Drought. Any stress that disrupts normal growth can contribute to prussic acid toxicity. Probably the most common cause of prussic acid poisoning in sorghums is drought. Drought-stricken plants consist mainly of leaves. Animal poisoning can result from grazing or green chop feeding. Regrowth following drought can have deadly concentrations.

Freezing. Sorghum is resistant to light frosts in the fall. Initial frosts may kill only the tops of sorghum plants, leaving the lower portions alive. New shoots can later emerge and are likely to have a high prussic acid potential.

Fertilizer. High nitrogen fertilizer along with low soil phosphorus and potassium can increase HCN hazard.

Animals. Ruminants are more susceptible than horses and swine. Sorghums, however, are not recommended for horses for other reasons (See *Sorghums and sudangrass - management for supplemental and emergency forage* for more information.) Cud chewing and rumen bacteria enhance HCN release.

What can be done to avoid prussic acid poisoning?

Grazing management. Wait until forage is at least 18 to 24 inches tall before initial grazing. Be particularly cautious if drought slows or stunts growth. Chances of prussic acid poisoning can be reduced by heavy stocking rates and rotational grazing. This reduces selective grazing of leaves. Ground corn or other cereal grain can be fed prior to turn out. Grain carbohydrates tend to inhibit emulsin from hydrolyzing dhurrin and forming HCN. Feeding hay before turn out reduces intake of sorghum forage and dilutes the cyanide. In order to avoid poisoning from frost regrowth, wait until at least five days after a frost that kills new shoots before grazing. Another precaution with grazing live vegetation is to turn in a test animal(s) rather than the whole herd to determine if there may be a problem.

Green chop. Chopping eliminates the problem with selective grazing, and the chopping helps release prussic acid before utilization; however, material that is very high in prussic acid potential can still pose a hazard since forage is usually fed shortly after chopping. If nitrate accumulation is suspected, green chop should not be allowed to heat up (ie, be left in a wagon overnight), as nitrate toxicity increases under these conditions.

Silage. Sorghum that has been ensiled is generally safe for livestock feeding. Much of the poi-

sonous gas escapes during fermentation and in the process of movement to feed bunks. Silage should not be fed for at least three to four weeks after ensiling, however.

Hay. Prussic acid potential declines substantially during cutting and curing and is rarely a problem with hay feeding. One practice that has proven successful in Wyoming is swathing, raking into windrows and leaving forage in the field for fall and winter grazing. The cutting tends to preserve more forage nutrients than what can be preserved from leaving forage standing, and there is generally little weather damage since precipitation declines through the fall. Animals eat the windrowed forage as well as hay, saving the cost of baling, hauling, and feeding. There is less leaf loss compared to waiting until the crop dries up following a killing frost.

Symptoms and treatment

Death can occur within minutes if large quantities of forage with high prussic acid potential are consumed. Animals consuming smaller amounts over time will show, in progression, excessive salivation, increased respiratory rate, staggering, falling, severe convulsions, then death. Animals can survive once symptoms have begun if removed from the forage. Treatment usually involves administering sodium nitrite and sodium thiosulfate by a veterinarian. Forage high in prussic acid potential can also be high in nitrate, and the animal symptoms can be similar. See the bulletin *Managing forage to reduce nitrate poisoning of livestock* for further information.

Lab analysis

Suspect forages can be analyzed for prussic acid or hydrogen cyanide potential hazard. See the University Extension Educator in your county for assistance in obtaining a representative sample and lab analysis. Table 1 shows the effects of various levels of prussic acid in forages.

Table 1. Hazard level of forages with various levels of prussic acid.

Prussic acid content (dry basis)	Comment
Less than 600 ppm	This feed should not cause prussic acid poisoning.
600-1800 pm	This feed is potentially toxic; it should be fed in restricted amounts. If pastured, animals should be monitored closely and removed immediately if they show any signs of discomfort.
Over 1800 ppm	This feed is potentially very toxic; it should be fed at a very restricted rate if at all. Drying or ensiling or allowing the forage to mature will reduce its prussic acid content.

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