

# **Minimizing the Prussic Acid Poisoning Hazard in Forages**

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Sudangrass, forage sorghums and sorghum-sudangrass crosses (all in the genus *Sorghum*) are often planted for summer pasture and sometimes fed as green chop, silage or hay. Under certain environmental conditions, livestock may develop symptoms of prussic acid poisoning when these forages are pastured or fed as green chop.

Death can result from prussic acid poisoning, most commonly when livestock have fed on plants that are either very young, stunted by drought or frosted. Cattle and sheep are more susceptible than swine, since they are more likely to consume large quantities of the poison.

## **What Prussic Acid Poisoning Is**

Most of the prussic acid in plants exists as a bound, non-poisonous chemical called dhurrin. It is present in most sorghums, but some species and varieties contain less than others.

Also present in the sorghums is a material called emulsion, which under certain conditions can react with dhurrin to form prussic acid (also referred to as hydrocyanic acid). If plants are damaged, such as by freezing, chewing or trampling, the emulsion-dhurrin reaction is enhanced, freeing sufficiently larger quantities of poison (cyanide) to cause a potentially hazardous condition.

Prussic acid is extremely poisonous. A concentration greater than 0.1 percent of dry tissue is considered highly dangerous.

## **Signs of Prussic Acid Poisoning**

The signs of prussic acid poisoning appear suddenly--i.e., within 15-20 minutes after animals consume the "tainted" forage. These visual symptoms include staggering, labored breathing, spasms and foaming at the mouth. Affected animals then often lie prostrate and thrash about. Treatment must be administered quickly to prevent death.

## Factors Affecting Prussic Acid Content In Plants

Species. The vegetative portion of all sorghums contains prussic acid. Generally, however, prussic acid content in sudangrass is about 40 percent less than in most other sorghums. As a group, the sorghum-sudangrass hybrids have more prussic acid than sudangrass. Crosses have now been developed, however, that contain extremely low quantities. As a precaution, plant those hybrids known to be lower in prussic acid.

Johnsongrass, shattercane and sorghum almum could contain dangerous levels of prussic acid, and may be hazardous in pure stands or as contaminants in sudangrass or sorghum-sudan cross pastures. Fence rows contaminated with these weedy species might also be hazardous. Plants of the *Prunus* genus, such as wild black cherry trees (*P. serotina*), chokecherry (*P. virginiana*) and pin-cherry (*P. pennsylvanica*) are potential problems and should be eliminated from grazing areas.

Pearl millet, another summer pasture crop, does not contain toxic levels of prussic acid.

Plant Parts In the sorghums, leaf blades normally contain higher prussic acid levels than leaf sheaths or stems, the heads are low in prussic acid, and the seeds contain none. Upper leaves have more prussic acid than older leaves. Tillers and branches ("suckers") have the highest levels, because they are mostly leaves and not stalk material.

Maturity. Highest prussic acid levels are reached before the boot stage. As plants mature, the stalks make up a greater proportion of the plant, causing prussic acid content in the total forage to decrease. However, the hazards associated with poisoning may decrease only slightly with age if animals selectively graze those plant parts that are high in prussic acid.

Drought. Severe drought is probably the most common cause of prussic acid poisoning. Drought-stricken plants are hazardous to feed because they are mostly leaves. Sorghum grazed or fed as green chop in the heart of a drought may retain high levels of this poison.

Freezing. Cold weather may kill only the tops of sorghum plants, leaving the lower portion alive. The unbound prussic acid in this forage does not decline until wilting begins. The forage is usually considered safe to pasture or feed as green chop 5-6 days after a killing frost. New shoots emerging from unkilld portions of the plant are apt to be high in prussic acid. Therefore, this forage should not be used until that new growth reaches a height of 2 feet.

Fertilizer. The excellent yield potentials of sudangrass, sorghum-sudangrass crosses and forage sorghums can only be attained by applying high rates of nitrogen fertilizer (e.g., 200 pounds per acre or more). However, if high N rates are applied to soils deficient in phosphorus and potassium, prussic acid levels usually increase.

Therefore, to reduce the hazard of prussic acid poisoning, maintain phosphorus and potassium levels according to soil test report recommendations. Also consider split-applying heavy N rates into 2-4 applications.

Herbicides. 2,4-D may cause prussic acid content to increase in forages. The effect may last several weeks.

## **Safe Feeding of Potentially Hazardous Forages**

Pasture. The risk of prussic acid poisoning can be reduced by feeding ground cereal grains to the animals before turning them out to graze. Carbohydrates in the grain tend to inhibit the emulsion from hydrolyzing dhurrin, which causes prussic acid formation. The chance of problems on pasture can be further reduced by using heavy stocking rates (4-6 head per acre) and rotational grazing.

Deaths on pasture are partially caused by cattle selectively grazing leaves and shoots. These plant parts may contain 2-25 times more prussic acid than stems. Cattle may also avoid frost-damaged leaves and shoots, grazing instead the young suckers lower on the plant that could contain lethal levels of prussic acid. Therefore, if new shoots develop after a frost, the crop should not be grazed until this new growth is 2 feet tall.

In most cases, grain sorghum stubble can be safely pastured because cold weather is likely to have killed the plants before they are grazed. However, the stubble should be observed carefully for dangerous suckers that may develop after the main stalks have been killed. Sorghum that has wilted and dried 5-6 days after being killed by frost is considered safe for grazing.

Green Chop. Green chop forage is usually safer than the same material used for pasture because it is not selectively grazed. Whereas in the case of pasture only the leaves may be eaten, with green chop material the total plant is consumed. Stems act as safety devices 'diluting' the high prussic acid content of leaves.

Silage. Sorghum silage is generally safe for feeding. Although it could contain toxic levels of prussic acid while in storage, much of the poison escapes as a gas during fermentation and when being moved for feeding. However, as a precaution, do not feed new silage for at least 3 weeks after harvesting and storing.

Hay. The prussic acid content of sorghum hay decreases as much as 75 percent while curing and is rarely hazardous when fed to livestock.

**A Final Precaution.** Rather than expose the entire herd to danger, use test animals for brief periods when the silo is freshly opened or when turning onto questionable pasture.

## Treatment For Prussic Acid Poisoning

If large quantities of forage high in prussic acid are consumed rapidly, death can occur within a few minutes. However, the usual situation is that the animals consume smaller quantities of the forage over a longer period, causing first salivation, then a gradual increase in respiratory rate, followed by staggering, falling, severe convulsions and finally death within 45 minutes. Generally, animals that survive 2 hours after the onset of symptoms will recover.

Obviously, immediate treatment by a veterinarian is necessary to save the animals. Treatment includes administering sodium nitrite and sodium thiosulfate.

Poisoning caused by prussic acid is somewhat similar to nitrate poisoning. In fact, the treatment for prussic acid involves the inducement of a degree of nitrate poisoning (methemoglobinemia) by administering sodium nitrite. Simultaneous treatment with sodium thiosulfate converts the newly formed cyanmethemoglobin to thiocyanate and hemoglobin, which permits the blood to again transport oxygen normally.

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