Feeding Frosted Forages

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Sorghum and Sudangrass Forages

Prussic acid poisoning can occur when feeding sudangrass, sorghum-sudangrass hybrids, forage sorghum, or grain sorghum. These species contain varying concentrations of cyanogenic glucosides, which are converted to prussic acid, also known as hydrogen cyanide (**HCN**). As ruminants consume forage containing high levels of cyanide-producing compounds, prussic acid is released in the rumen, absorbed into the bloodstream where it binds hemoglobin, and interferes with oxygen transfer. The animal soon dies of asphyxiation. Prussic acid acts rapidly, frequently killing animals in minutes. Symptoms include excess salivation, difficult breathing, staggering, convulsions, and collapse. Ruminants are more susceptible than horses or swine because cud chewing and rumen bacteria help release the cyanide.

Generally, any stress condition that retards plant growth may increase prussic acid levels in plants. Hydrogen cyanide is released when leaves are damaged by frost, drought, bruising, cutting, trampling, crushing, or wilting. Plants growing under high nitrogen levels or in soils deficient in soil phosphorus or potassium tend to have high levels of cyanogenic glucosides. Species and varieties differ in prussic acid poisoning potential. Sudangrass varieties are low to intermediate in cyanide potential, and sorghum-sudangrass hybrids and forage sorghums are intermediate to high. Piper sudangrass has low prussic acid poisoning potential, and pearl millet is virtually free of cyanogenic glucosides. The management practices described below can reduce the risk of prussic acid poisoning from forage sorghum, sudangrass, and sorghum-sudangrass hybrids:

1) Graze or greenchop only when the grass is greater than 18 inches tall.
2) Do not graze wilted plants or plants with young tillers.
3) Do not graze plants during or shortly after a drought when growth has been reduced.
4) Do not graze on nights when frost is likely. High levels of the toxic compounds are produced within hours after a frost occurs.
5) Do not graze after a killing frost until the plants are dry. Wait 5 to 7 days to allow the released cyanide to dissipate.
6) Do not graze for two weeks after a non-killing frost.
7) Delay feeding of silage for 6 to 8 weeks after ensiling. Fresh forage is generally higher in cyanide than silage or hay because cyanide is volatile and dissipates as the forage dries. However, hay or silage that likely contained high cyanide levels at harvest should be analyzed for HCN content before feeding.
8) Split applications of nitrogen decrease the risk of prussic acid toxicity, and proper levels of phosphorus and potassium in the soil will also help.

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9) Don't allow hungry or stressed animals to graze young sorghum grass growth.

Nitrate poisoning can occur under conditions of high nitrogen fertilization, heavy manure applications, drought, overcast weather, prolonged low temperatures, or other stress conditions that retard plant growth. Under these stressful conditions, high nitrate levels accumulate in the crop. Once forage is fed, nitrate is converted to nitrite in the animal. When nitrite levels are high, the animal cannot metabolize it quickly enough, and nitrite inhibits oxygen transport in the blood. Symptoms include rapid breathing, fast and weak heartbeat, muscle tremors, staggering, and ultimately death if corrective steps are not taken.

The same management precautions for prussic acid poisoning will help prevent nitrate poisoning. Although pearl millet does not create a potential problem with prussic acid poisoning, it can accumulate high nitrate levels leading to nitrate poisoning. Also, corn for silage should be monitored for nitrate concentrations under conditions described above. High nitrate levels will persist when forages are cut for hay, but ensiling the crop will reduce nitrates by approximately 50%. If forage is suspected of high nitrate levels, have it tested before feeding.

Corn for Silage

Maturity of corn and risk of frost damage are often major factors for consideration during the early fall. Both of these factors will affect dry matter (DM) level of the corn. Corn harvested for silage should be no higher than 40% DM (not less than 60% moisture) when stored in upright concrete silos, no higher than 50% DM (not less than 50% moisture) for oxygen-limiting silos and no higher than 36% DM (not less than 64% moisture) for horizontal silos. Although a preservative is not usually recommended for corn silage, except on the last 2 to 3 wagon loads for upright silos, 1% propionic acid (as-fed basis) should be applied when DM levels are at or near the upper suggested levels. Urea (8 to 10 lb per ton) and anhydrous ammonia (7 to 9 lb per ton) should not be added to corn silage above 40% DM (less than 60% moisture). These additives will increase silage pH, which in conjunction with inadequate oxygen elimination in high DM silage, can reduce fermentation potential.

Generally, the quality of frosted corn is good until after several frosts or a major killing frost. In such cases, the plant will begin to die, causing leaf loss, and the cell rupturing caused by the frost will allow leaching of nutrients during rainfall. The major factor to be concerned about with frosted corn is not to allow it to become too dry before ensiling as the rate of drying will be accelerated after frosting occurs. The following data on frosted corn silage were collected by researchers in Canada:

Stage	Dates of Harvest	Dates of Frost	% DM at Ensiling	% CP	% NDF	% ADF
Milk	8/30		20.8	7.1	59.0	31.5
Dough	9/7		23.2	6.3	58.8	28.5
1st Frost	9/18	9/14	25.1	6.6	59.4	26.0
2nd Frost	9/26	9/14, 9/26	35.5	7.2	61.6	26.2
5th Frost	10/17	9/14, 9/26, 9/29, 10/11, 10/17	45.9	7.0	65.9	28.1

Performance by lactating cows in the study was not negatively affected by the frosted corn until it had been frosted on five times.

The major problem with high DM corn silage is inadequate packing for elimination of oxygen. Therefore, particle size of such silage is very important. Particle size of high DM silage should be smaller than for silage with adequate moisture. Cutter bars should be set at 0.25 inches and particle size monitored since sharpness of knives, throughput, etc. also affect particle size.

Water can be added, usually at the blower, to increase moisture level for improved packing. The main problem is being able to apply enough water – a high pressure system should be used. Unloading rate (tons/min) and water delivery rate (lb/min) should be monitored to achieve desired results. The table below can be used to determine how much water to add per ton:

Initial % DM	Desired % DM					
	44	42	40	38	36	34
	---------- lb water/ton ----------					
46	91	190	300	421	556	706
44		95	200	316	444	588
42			100	210	333	471
40				105	222	352
38					111	235
36						118