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# PLANTS MAY BE SOURCE OF TOXICITY TO CATTLE DURING DROUGHT

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During drought and other times of pasture shortage, cattle will increase their foraging and the possibility of consuming toxic plants increases.

Plants that are toxic to cattle may be classified as nitrate accumulators, cyanide (prussic acid) producers and undesirable plants (weeds) that may be present in pastures, wood lots and holding pens. The following is a discussion of each of these possible sources of toxicity.

## Nitrate Accumulators Are Sources of Nitrate Toxicity

All plants require some nitrogen for growth. Forage and grain producers typically apply nitrogen (as well as other fertilizers) to increase yields of field crops. When immature plants are damaged by drought or frost, nitrogen metabolism is interrupted and higher than normal levels of nitrate may be present in stems and leaves.

Cattle and other multi-stomached animals are at greater risk to nitrate poisoning because of bacterial action on the nitrate ion in the fermentative stomach. Bacterial action and pH can, and often do, convert the nitrate ion in forage to nitrite ion. The

nitrite ion oxidizes the oxygen-carrying iron in hemoglobin (red cell component), so it is no longer able to carry oxygen to the tissues from the lungs.

## SIGNS OF NITRATE TOXICITY

Cattle affected by nitrate toxicity may die very quickly, within 6 hours of eating materials containing nitrate. They are sometimes noticed to have difficulty breathing and may stagger. Blood from severely affected cattle will have a brownish, chocolate color. Tissues in a dead animal may also have a brownish discoloration. Blood can be analyzed for nitrate and nitrite levels for a short time after collection.

After consumption of forages with moderate levels of nitrate, the pregnant female may abort. The eye of the aborted fetus may be the only tissue of value in diagnosing nitrate-induced abortions.

## PLANTS THAT ARE NITRATE ACCUMULATORS

Nitrate accumulators can be grouped into range plants and crop plants.

**RANGE PLANTS**

| | |
|---|---|
| Pig Weed | Night shade |
| Brome grass | Johnson grass, sorghum, sudan grass |
| Lamb's quarter | Sweet clover |
| Jimson weed | Dock |
| Sunflower | Thistle |

**CROP PLANTS**

| | |
|---|---|
| Oat hay | Wheat |
| Corn | Rape, kale, turnip |
| Barley | |

### Diagnosis of Excess Nitrate in Plant Tissue

A. **Diphenyl Amine** kits are available in many county Extension offices. Agents

can assist in deciding whether plant material is high in nitrate using this test. Veterinarians doing large animal practice may have the kit. This kit should only be used as a presumptive test. If results are positive, a quantitative test can be done to determine the level of nitrates present.

B. **Diagnostic Laboratories and College of Veterinary Medicine Toxicology Labs** are able to determine amounts of nitrate in feed in parts per million by means of a chemical test. This analysis should help decide whether the amount of nitrate in the feed/forage is large enough to cause problems.

**Treatment of Nitrate Poisoning**

Often treatment is not successful.

**Methylene Blue** (4.4 - 22 mg/kg body weight) is given intravenously in a 1% solution. Mineral oil or magnesium sulfate laxatives may be given to speed the toxic plant material through the gut.

**Plants Can Be Sources of Prussic Acid, (Cyanic Acid) Toxicity**. Arrow grass (Triglochin supp.), Johnson grass (Sorghum halepense), Sudan grass (S. Vulgare var sudanensis) and Common sorghum (S. Vulgare) are commonly implicated.

Johnson grass is the most toxic of the grasses. It is likely to be troublesome if consumed by cattle under frost or drought conditions. Wilted leaves from Wild black cherry (Prunus serotina), Chockechery (P. Virginiana) and Pin cherry (P. Pennsylvanica) are also sources of prussic acid (cyanic acid).

The **Prunus** species typically are the most toxic as the leaves wilt cutting. The

wilting process apparently releases the prussic acid from its bound form.

Freezing of leaves, as well as treatment with herbicide which causes wilting, may lead to high content of prussic acid in the following group of plants such as Cat claw, Bahia, Velvet grass, Hydrangea, Birdsfoot trefoil, White clover, Vetch seed, Corn, Maize and Flax.

**Mechanism of Production of Cyanide (Prussic Acid) in Plants**

Certain plants have especially high levels of cyanide early in their growth phase or have the ability to concentrate high levels during time of stress such as a drought.

Frosting and drought, while the plant is in an active growing stage, cause release of cyanide acid (prussic acid) from its bound state within the plant.

The effect of cyanic acid is to prevent the movement of oxygen from blood into tissues. Cells of the brain are most sensitive to lack of oxygen. Because of lack of oxygen due to prussic acid, the brain calls for more oxygen and the circulating venous blood becomes oxygenated and bright red in color.

**Signs of Toxicity From Cyanogenic Plants**

Animals consuming plants containing large amounts of Cyanide quickly show signs because of the blocking of transfer of oxygen to the tissues.

Consumption of lethal amounts leads to death in a few minutes. Smaller amounts cause salivation and difficult breathing in 5 to 10 minutes following eating.

Distressed breathing, muscle tremors and an increased heart rate are common

signs. Most animals stagger and struggle before becoming unable to stand. Generalized muscle spasms precede death. Mucous membranes are bright red while the animal is breathing. Acute death usually occurs within 30 minutes of beginning of signs. Animals living 1½ to 2 hours following the beginning of signs usually recover.

**Diagnosis of Cyanide Toxicosis**

Presence of cyanide-containing plants, physical signs in affected animals and characteristic color (bright red) of venous blood may be sufficient evidence to make a diagnosis. Rumen content collected from dead animals and forage should be sealed in an air-tight container on collection, refrigerated and promptly submitted to a laboratory for diagnosis.

**Treatment**

Often treatment is not successful.

If available, a commercial mixture of 3% sodium nitrite and 30% sodium thiosulfate can be given intravenously at the rate of 1 ml. Per 4.5 kg (10 lb.)

**Toxic Plants of Late Summer and Fall**

Rains of the late summer bring many toxic plants to full flower, as well as cool season fescue and other desirable forage plants.

**Perilla Mint** is a purplish-green plant with a “square” stem (practically diagnostic). Also a “minty” odor is smelled. It grows luxuriantly in barn lots and fence rows where animal waste has fertilized the soil. Cattle, especially if shut up over night in a lot containing perilla, will graze this plant aggressively. Signs of

sickness are those of respiratory disease: difficult, open mouth breathing and difficult expiration, collapse and often death. Treatment is often not very helpful. Death often follows consumption of perilla mint. Frost makes perilla more palatable to cattle.

**Family Solanaceae** contain solanine alkaloids which produce diarrhea, convulsions, weakness, coma and death. Among the domestic plants of this type are **tomato, potato, egg plant, ground cherry and pepper.** The vines of all these plants contain the toxic alkaloid principle. Also, the green portion of potato tubers exposed to sunlight may contain solanine.

**Solanaceae** regarded as weeds include the various nightshades (prickly, black, cutleaf, hairy) horse nettle, bittersweet, buffalo burr, Jimson weed and bull nettle.

Residues from gardens such as tomato and potato vines, potatoes left in the field and kitchen residues containing these items should not be fed to livestock.

**Ergot Poisoning**

Ergot is the common name for the fungus **Claviceps sp** which invades various grasses (both wild and domesticated), such as dallis grass, wheat, rye and barley. Ergot is also the visible structure which results as the fungus invades the seed head. As the fungus develops within the grass flower, a hard, pink or purplish structure gradually replaces the seed head. This hard mass usually becomes 3 to 4 times larger than the seed it replaces.

Animals became hyperexcitable and belligerent. Trembling and incoordination follow and affected animals may become “downers”. They continue to eat and drink,

but may drown if they collapse into a stream or water tank. Removal from pasture contaminated with ergot usually brings recovery, if water and feed are available.

Another form of ergotism results in constriction of blood vessels to a limb or the tail. Loss of circulation to the extremities can cause death of tissues and eventual sloughing of the affected limb(s) or tail. Abortions have been seen when ergot contaminated grasses are fed to livestock.

The ergot structure in seed heads should be readily visible on close examination. Removal of cattle from pastures infected with the fungus **Claviceps** usually results in recovery.

Many other toxic plants are present in the Tennessee forage environment. Cattle generally avoid toxic materials if other palatable forage is available. However, hungry cattle do not discriminate and readily consume perilla mint and grasses containing ergot, as well as other toxic plants. This would be especially true during times that forage is limited.

## REFERENCES

Current Veterinary Therapy 2, Food Animal Practice, Jimmy L. Howard. Ed. W. B. Saunders, (1986)