Ministry of Agriculture and Food
Ontario

ORDER NO. 87-016
FEBRUARY 1987
AGDEX 130/643

Factsheet

POISONING OF LIVESTOCK BY PLANTS

S.E. Robinson, Plant Industry Branch
J.F. Alex, Department of Environmental Biology, University of Guelph

INTRODUCTION

There are many plants which contain chemicals or which accumulate chemicals that are poisonous to livestock. The results of poisoning can range from minor irritations and slightly lowered animal performance to severe cases where the animal is in a great deal of distress and may die. This Factsheet is an introduction to the ways and means that plants can poison livestock. It also describes plants which mechanically injure animals or may cause irritation of skin on contact. For additional information on weeds that are poisonous see the OMAF Factsheets *"Common Weeds Poisonous to Grazing Livestock, Part A and Part B"*. Agdex 130/643.

It would simplify matters if plants could be classified into two groups, poisonous and non-poisonous. Unfortunately, this cannot be done for many factors are responsible for the toxic principles in plants. What may be a harmless plant species in one circumstance could be deadly in another.

There are many plant factors that contribute to the toxic principles in plants. Individual plant species and varieties may differ in their poisonous content from early growth to maturity. With some plants, there is an increase in their ability to poison with advanced stages of growth, whereas with others the danger lessens. The state of the plant when eaten may also be important. In some cases, damage to the plant or wilting may produce poisonous chemicals in the plant which were not present in the fresh material. In other cases, such as with buttercups, the poison is contained in the fresh plants but not dried ones. Certain parts of a plant may be poisonous and other parts not. Rhubarb is a good example. The leaf stalk is eatable while the leaves are very poisonous.

Animal factors also influence the ability of plants to poison. Different animal species are susceptible to different plants and poisons. The age of the animal is also important. Young animals are often more susceptible than older ones, but it isn't always the case. Animals may build up resistance to certain poisons by being exposed to small quantities at first. Then, if a large quantity is consumed, they are resistant because their metabolism has already adjusted to handle the poison. An animal that is hungry or has certain dietary deficiencies is more likely to eat toxic quantities of a poisonous plant than a well fed animal.

CLASSIFICATION OF POISONS

There is a large variety of toxic substances that have been associated with plant poisonings. Unfortunately for many plant species, the nature of the toxic substance has not yet been identified. However, most of the important poisonous plants in Ontario contain toxic agents from one or more of the following groups.

1. **Alkaloids** are organic basic substances with a bitter taste, examples of which are morphine, atropine, nicotine, quinine and strychnine. The alkaloids generally are irritating to the gastrointestinal tract producing **nausea, colic** and **diarrhea** and also act on the central nervous system to produce **blindness, muscular weakness, convulsions** and **death.** Toxic alkaloids are found in the following plants; swamp and death camas, lupines, buttercups, marsh-marigolds, larkspur, the nightshades, squirrel corn and Dutchman's breeches.

2. **Glycosides** are natural plant products that contain the sugar glucose. They can be subdivided into three main groups. (a) Cyanogenic glycosides are not themselves poisonous but in the presence of certain enzymes are hydrolyzed and produce hydrocyanic acid (HCN) which is highly toxic. HCN interferes with the oxygen exchange from the lungs to the body tissues so that various tissues including the brain are starved for oxygen and are consequently injured. The symptoms are **muscle tremors, difficult, rapid respiration and convulsions.** Often these are not seen because **death** occurs within minutes.

   There are many factors that influence the amount of cyanogenic glycosides in plants. Some plant species normally have high levels, the highest levels occurring in early growth stages and decreasing as the plants mature. Climatic conditions, soil factors, shade and other factors that slow plant growth and development

increase cyanogenic glycoside content. Low soil moisture, high nitrogen and low phosphorus all favor HCN production. Wilting, frost and other forms of physical damage to plants may induce a rapid increase in HCN content.

Cyanogenic glycosides occur in sorghums, sudan grass, marsh-arrow grass and wild cherries.

(b) Saponin glycosides produce a violent gastroenteritis with **vomiting, diarrhea** and **colic.** If the saponin glycosides are absorbed into the bloodstream, they cause a breakdown of red blood cells and injury to the central nervous system producing **convulsions** and **paralysis.** This form of glycoside is found in purple cockle, cow cockle, bouncingbet and pokeweed.

(c) Mustard oil glucosides found in plants belonging to the Mustard family cause severe gastroenteritis. Symptoms are **severe colic** and **purging.**

3. **Nitrate** poisoning of animals is actually nitrite poisoning occurring when nitrate is reduced to nitrite in the gastrointestinal tract. The nitrite is absorbed into the bloodstream where it reacts with hemoglobin to form methemoglobin. This compound, which is brown in color, is incapable of releasing oxygen. In acute cases of poisoning in cattle, 60 to 80% of the total hemoglobin is comprised of methemoglobin. Sheep generally do not develop as much methemoglobin and are therefore more resistant to this form of poisoning.

   The symptoms of acute poisoning are **trembling, staggering, rapid breathing, and death.** Chronic poisoning may result in **poor growth, poor milk production** and **abortions.** In cattle, there is evidence that vitamin A storage is affected.

   Some plant species are naturally good accumulators of nitrates. Common plant species that are associated with nitrate poisoning are shown in Table I. The legume and grass species that are used for pastures or hay crops are not considered good nitrate accumulators, but given the right conditions can accumulate concentrations of nitrate that are potentially hazardous.

   There is a direct response in plant nitrate concentration to increasing levels of nitrogen fertilization. Nitrate accumulation is greater when nitrate fertilizers are used than when either urea or ammonium sulfate is the nitrogen source.

   A number of environmental conditions can influence the accumulation of nitrates in plants by altering mineral metabolism in the plant. Drought, uneven distribution of rainfall, and low light intensity have each been identified as climatic factors that bring about an accumulation of nitrates and nitrites in the stems and leaves of plants.

Table I. Common plants that are capable of accumulating high amounts of nitrate.

Weeds	Crops
prostrate pigweed	oats
tumbling pigweed	rye
rough pigweed	wheat
lamb's quarters	barley
Canada thistle	corn
Russian thistle	sorghum
milk thistle	sudangrass
annual sow thistle	sugar beets
perennial sow thistle	mangels
poison hemlock	turnip
wild morning glory	rutabaga
spotted spurge	rape
prickly lettuce	kale
witch grass	broccoli
	cucumbers
	squash
	celery

4. **Molybdenum** poisoning can occur when there are abnormally high quantities of molybdenum in the soil. Animals pasturing on areas that meet this condition are often subject to **acute scouring.** The animals become **emaciated, produce less milk,** and **their coats become rough** and **often faded.** Legumes, particularly red and alsike clovers, are usually associated with molybdenum poisoning. To counteract the effect of molybdenum, it is necessary to add copper to the diet of the animals. A veterinarian should be consulted first before feeding copper.

5. **Copper** may also accumulate in plants in amounts great enough to cause toxic effects if soils are rich in copper or deficient in molybdenum. Clovers are good accumulators of copper and are generally associated with copper poisoning.

6. **Selenium** is a highly toxic element when taken in quantities larger than what is needed for normal metabolism. In most plants, the level of selenium is related to levels in the soil. The symptoms of selenium poisoning are: **dullness, stiffness of joints, lameness, loss of hair from mane or tail and hoof deformities.** The acute form of poisoning is often called **"blind staggers".**

7. **Ergot** is a fungus that infests grasses and if eaten in sufficient quantities is poisonous due to the production of a mycotoxin. Ergot's presence is observed by hard, dark-colored masses in flowering grass heads. These purplish or dark brown masses are usually two to five times larger than the grass seed and are called ergot bodies.

The active toxin, ergotoxine, stimulates the nerve centers that cause contraction of the small blood vessels supplying the different parts of the body. The result of ergot poisoning depends largely upon the amount of the fungus consumed. When only small quantities have been taken in, recovery without any serious symptoms may take place. Where large quantities have been consumed, **dry gangrene in the extremities, possible abortion in pregnant animals and death** may result.

General symptoms such as **lack of appetite, dullness, abdominal pain,** and **subnormal temperature** are common. Two distinct types of symptoms may develop in severe cases: **(1) nervous,** and **(2) gangrenous.**

(1) Nervous form

Dullness and depression are evident. There may be muscular trembling, convulsions, contractions of legs, and delirium. The animal suffers from gastrointestinal catarrh, refuses food, and gradually develops a wasting condition. A very rapid type in which the animal may die in spasms or convulsions is sometimes seen.

(2) Gangrenous or general form

The stoppage of blood due to the contraction of the small blood vessels causes necrosis (death) of the extremities, particularly the feet, the tail, or tips of the ears. The affected part is cool, and dries up; a small furrow or line of separation appears and completely surrounds the limb, dividing the living tissue from the dead. There is little or no loss of blood, and seldom any pus present. Death may also occur due to the invasion of bacterial organisms, "secondary invaders", as well as from gangrene. Cases that do recover may be crippled for life.

The following are some of the crop, pasture and wild grasses on which ergot has been known to develop: oats, barley, wheat, rye, red top, bent grasses, meadow foxtail, brome grasses, orchard grass, reed canary, timothy fescues, blue grasses, quack grass, poverty oat grass, and foxtails.

8. Other **mycotoxins** are produced by some fungi that infect corn and cereals. The mycotoxins are produced only if the right environmental conditions are met and these conditions vary depending on the fungus. It is possible for mycotoxin production to take place while the crop is still standing in the field or after it is harvested and in storage.

   In Ontario, the two most common forms of mycotoxins are vomitoxin and zearalenone. Vomitoxin causes the animal which eats the contaminated feed to **vomit.** Usually, however, animals refuse to eat the feed. Zearalenone is a female estrogen. Symptoms in swine, the class of livestock that is usually affected, are as follows: females show signs of **irregular heat,** immature gilts develop a **marked swelling** and **inflammation of the external genital organs, reduced litter sizes,** and **males may lose libido.**

9. **Coumarin,** a chemical found in sweet clover, is responsible for the reduced palatability of this legume and is associated with a reduced blood clotting ability in the animals who eat sweetclover. Coumarin itself, however, does not cause this latter problem. Dicoumarol, a chemical derived from coumarin, during heating or spoilage of sweet clover hay or silage is the chemical that is responsible. If the clotting ability of the blood is lowered, it is possible that animals may bleed to death from slight wounds, dehorning, castrating or from internal hemorrhages.

OTHER TYPES OF POISONING OR INJURY TO ANIMALS

1. Photosensitization

Certain plants contain toxic agents which, when eaten, render the animal sensitive to strong sunlight. The damage that results can range from sunburning and swelling of the sensitive areas to the formation of ulcers and gangrene. Animals may also become blind.

Photosensitization cases are divided into two groups, primary and hepatogenic. Primary phototoxic plants have toxins that directly photosensitize the skin either through contact or by ingestation. When eaten, the toxins are absorbed and circulated in the blood to the skin where they are activated by the rays of the sun. The unpigmented (white) skin is affected.

The second group, the hepatogenic phototoxic plants, do not directly cause photosensitization. These plants have toxins that damage the liver. The liver damage prevents a breakdown product of chlorophyll (phylloerythrin) from being removed in the bile fluid. The phylloerythrin is circulated to the capillaries of the skin where it is activated by the sun and produces symptoms similar to those with primary photosensitization. It is important with hepatogenic cases to treat the damaged liver.

Saint John's-wort, spring parsley and buckwheat cause primary photosensitization. Blue-green algae causes hepatogenic cases.

2. Plants affecting milk and its production

Certain plants are known to decrease milk production. They may also make the milk or milk products unpalatable

and unsuitable for human consumption. The following lists some of these plants.

curled dock	false flax	stinking mayweed
broad-leaved dock	flixweed	ox-eye daisy
wild onion	wild mustard	ragweed
wild garlic	hedge mustard	tansy
buttercup	turnips	absinth
marsh marigold	rape	wormwood
lupines	spurges	white snakeroot
Saint John's-wort	buckthorn	chicory
wild carrot	yarrow	stinkweed
burdock	garlic mustard	jimsonweed

3. Algae in Water

Water may contain blue-green algae which can poison livestock. This type of algae is usually found in stagnant or slow-moving water during July and August. Long periods of warm weather and a high content of organic matter in the water favor its growth.

As a general rule, symptoms develop very rapidly and resemble an allergic reaction. Animals may be found dead at the water's edge or after having walked a few metres. **Convulsions may occur,** but more frequently the **animal sinks to the ground,** and **dies without struggling.** Smaller amounts of poison cause **weakness** and **staggering,** followed by recovery.

In some instances, apparent recovery from an attack is followed in a few days or weeks by evidence of **photosensitization.** There may be **inflammation of the muzzle, the skin of the ear, the udder, or other parts of the body. Jaundice** is often seen, and **constipation** is a common symptom. Such cases usually recover under good care.

4. Plants Causing Mechanical Injury

Some plants cause physical or mechanical injury to animals, and this injury may be external or internal. When this occurs, there is also the danger of infection of these injuries which may prove to be even more serious. This is sometimes the case with Canada thistle.

The barbs or awns of foxtail barley, downy brome, and wild rye are often troublesome in the mouths and throats of animals that have fed on these plants. The small, backward-pointing spines cause the awns to stick in the mouth or throat, and they are difficult to dislodge.

The spines of the fruit of the sandbur are quite stiff, and an animal grazing may injure its muzzle while cropping, or if burs get into its mouth they may cause a painful injury.

The burs of cocklebur and burdock, are also a source of annoyance. When the burs are eaten, they form an indigestible ball in the stomach. The spines injure the wall of the digestive tract and may thus open the way for secondary infection.

The sap from some plants, such as the spurges and buttercups, is a source of irritation to the skin of animals. After contact with the plant juices, the skin becomes inflammed and painful blisters may form. This type of damage to the mouth reduces the animal's desire or ability to eat.