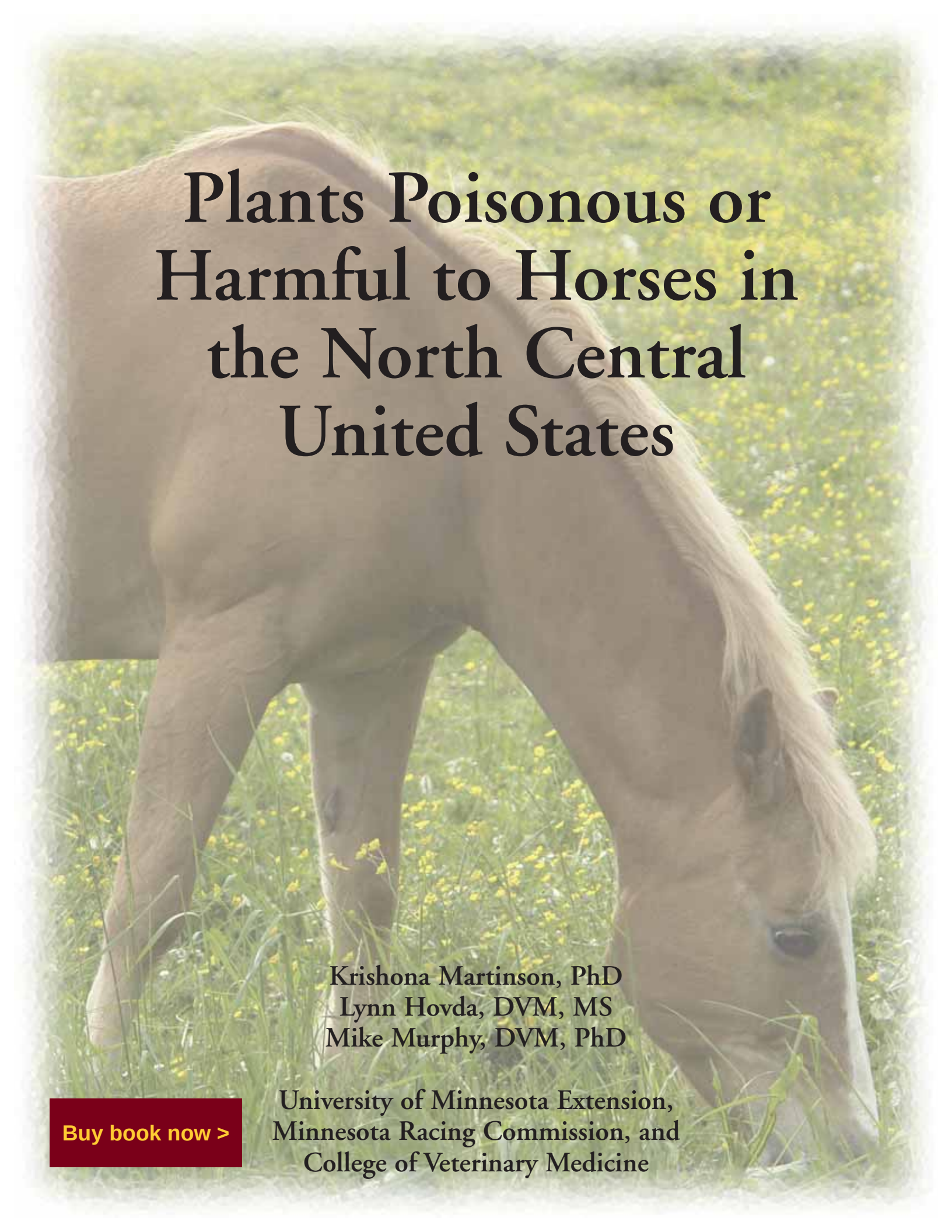

Plants Poisonous or Harmful to Horses in the North Central United States

Krishona Martinson, PhD
Lynn Hovda, DVM, MS
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Introduction

This book presents researched based information on 18 plants or groups of plants that commonly cause poisoning, and are frequently inquired about by horse owners in Minnesota and the North Central States.

The key to preventing problems with poisonous plants is proper identification and avoidance of these plants. Photographs in the book will assist horse owners in becoming familiar with plants that can cause problems. Examine pastures, hay fields, roadsides and fence rows for poisonous plants. In a drought year, or a year when feed is short, take extra precautions, and look for these plants in new areas planned for grazing or haying. Horses, under conditions of adequate feed, will avoid most poisonous plants. However, when feed is short, or horses are hungry, plants normally avoided become a tempting source of feed, thus a potential poisoning problem.

When a horse goes off feed, loses weight, colics, or appears unhealthy, poisonous plants may be the cause. Poisonous plants contain toxic compounds which can injure horses or kill, even in small doses. Others contain substances which cause a reduction in performance, such as weight loss, weakness, rapid pulse, or recumbency. Poisonous plants should be considered as the potential cause of disease, especially if the following situations exist:

1. Forage supply in a pasture is sparse due to overgrazing, drought or poor early season growth.
2. Animals have recently been moved into a new pasture.
3. Animals have been released into a new pasture when hungry.
4. Herbicides have recently been used to control weeds.
5. Pasture has recently been fertilized with nitrogen.
6. A new forage source (i.e. hay or pasture) has been fed.

Some herbicides may increase the palatability of these weeds. Therefore, it is important to read the herbicide label and follow all grazing restrictions. Also, if there are poisonous plants in the pasture, it is best to keep all livestock out until the plants have died or until the grazing restriction has passed.

Other management tips to avoid problems include:

1. Avoid overgrazing pastures.
2. Avoid turning hungry animals into new pastures.
3. Learn to identify poisonous plants.
4. Fence off areas in pastures where poisonous plants occur.
5. Control and/or manage weeds.
6. Follow herbicide grazing restrictions.
7. Supply adequate amounts of clean, fresh water at all times.
8. Consult your veterinarian to correctly identify and treat a suspected poisoning.

Black Walnut

Black walnut leaves

Dark black walnut shavings surrounded by lighter-colored pine shavings

Black Walnut: *Juglans nigra.*

Origin: Black walnut is used for furniture, gunstocks, and veneer, and is considered one of the scarcest and most coveted native hardwoods. It is the most commonly planted nut tree in North America, and has been cultivated since 1686.

Lifecycle: Black walnut trees are perennials. Most seedlings germinate from nuts buried by squirrels. Black walnut trees mature in about 150 years, but may live for 250 years.

Identification: Often a large tree with a massive, round, somewhat open, symmetrical canopy appearance. Leaves are composed of 11 to 13 leaflets that are long and toothed. The bark is dark brown to nearly black and deeply furrowed. Black walnut flowers generally appear in April through June. The large edible nut ripens in September or October, dropping shortly after the leaves fall. Black walnut shavings are much darker than light pine shavings (see photo).

Distribution: Eastern half of the United States except the northern border; Massachusetts south to NW Florida, west to central Texas; north to SE South Dakota.

Habitat: Prefers moist, well-drained soils, especially along streams and rivers; usually found scattered in mixed deciduous forests.

Control: Black walnut shavings should not be used in horse bedding. Black walnut shavings are commonly associated with furniture manufacturers.

Toxin: Experimentally, signs of toxicity usually occur after oral exposure to the black walnut heartwood (inner most wood), but toxicity after dermal exposure is commonly believed to occur as well. The chemical structure of the toxin is not known. Juglone was initially believed to be the toxin, but toxicity has not been reproduced with either oral or dermal dosing of juglone.

When Toxic: Use of black walnut shavings for bedding.

Toxicity: Clinical signs may be observed within a few hours of horses bedded with as little as 20% fresh black walnut shavings made from either new or old wood.

Signs and Effects of Toxicosis: Depression, limb edema (stocking up), warm hooves, acute laminitis (founder), stiff gait, and reluctance to move can be seen within a few hours of exposure. Flared nostrils, abdominal pain (colic), edema (swelling) of the neck and chest, elevated heart and respiratory rates, and high body temperature may be seen as the toxicity progresses. Laminitis may result in rotation of the coffin bone in severe cases.

Treatment: Clinical signs often subside within hours of removing bedding containing black walnut shavings. A mild sedative and mineral oil may be useful in some cases. Non-steroidal, anti-inflammatory drugs such as phenylbutazone (Bute) or flunixin meglumine (Banamine) are often used. Adrenergic blockers such as prazosin, and calcium channel blockers such as nifedipine may be used in rare instances.

Other Information: Black walnut roots and leaves excrete a compound called juglone which inhibits the growth of other susceptible plant species growing nearby. This inhibition is referred to as allelopathy. See the oak fact sheet for a discussion of kidney effects that may occur from ingesting the outer green hulls of the nut.

Chokecherry

Chokecherry in bloom

Fall leaf color of chokecherry

Mature chokecherry tree

Chokecherry: *Prunus virginiana.*

Origin: Native to Canada, chokecherry is a widely planted species that has been cultivated since 1724.

Lifecycle: Chokecherry is a perennial tall shrub or occasionally a small tree.

Identification: Chokecherry reaches a mature height of 6 to 10 feet and has an irregular, rounded top, often with a crooked or leaning trunk. The leaves are toothed and usually ovate. The long spikes of flowers bloom in June and the "cherries" ripen in August.

Distribution: Found from Newfoundland to Saskatchewan and south to North Carolina and west to Kansas.

Habitat: Chokecherry commonly grows on open sites with rich, moist soils, such as along fence rows and streams, on cleared land, and bordering wooded areas. It is relatively intolerant of shade.

Control: All chokecherries, and other cherry species, should be removed from horse pastures. Do not plant cherry species in horse pastures.

Toxin: Cyanide.

When Toxic: Cyanide is released from the cyanogenic glycoside (precursor to cyanide) after chewing the forage or seed, or wilting of the forage (i.e. after a frost). The cyanogenic glycoside may be present in higher concentrations in the forage of a young or rapidly growing plant.

Toxicity: Members of the *Prunus* (cherry) genus of plants have varying amounts of cyanogenic glycosides in the leaves and seeds of the plants. The Agucatillo *(P. brachybotrya)*, cherry laurel *(P. laurocerasus)*, black, wild, or rum cherry *(P. Serotina)* and chokecherry *(P. virginiana)* tend to have more cyanogenic glycoside in the foliage. Apricots *(P. armeniaca)* and peaches *(P. Persia)* tend to have more cyanogenic glycoside in the seeds.

Signs and Effects of Toxicosis: Animals are most commonly found dead within minutes to a few hours of ingestion of the plant. Rarely, terminal seizures may be observed.

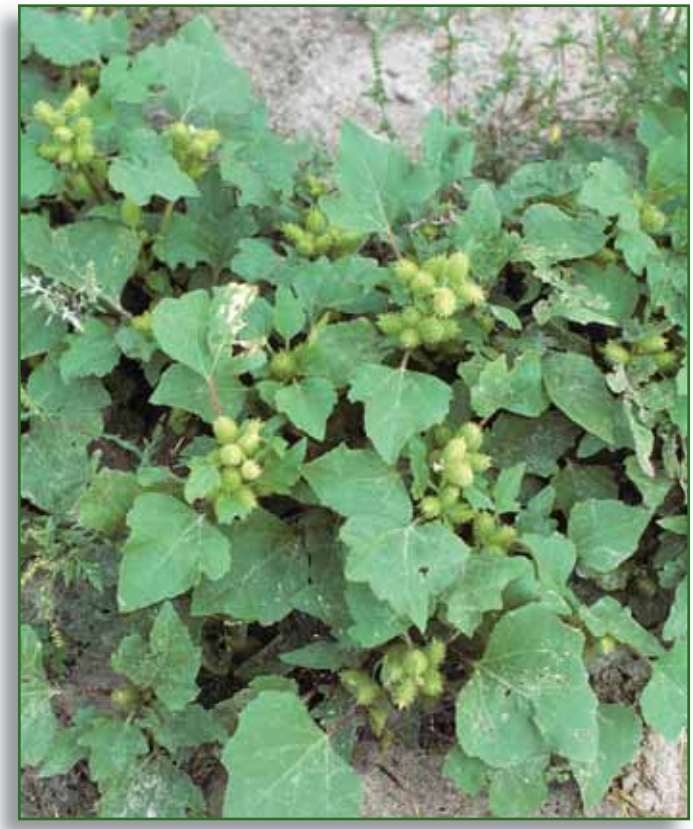
Treatment: The opportunity for treatment is rare. Sodium nitrite and thiosulfate may be administered in an attempt to treat cyanide toxicity.

Other Information: The fruit of chokecherry (and other cherry species) is not poisonous to humans and is commonly used for making jams, jellies, pies, sauces, and wines.

Common Cocklebur

Seedling

Close-up of mature plant


Mature plant

Common cocklebur bur

Scientific Name: *Xanthium strumarium.*

Origin: Native to North America.

Lifecycle: Annual, reproducing by seed.

Identification: Cocklebur seedlings have long, narrow, fleshy cotyledons (first leaves) which taper to a point at the tip. Stems are hairy, rough, frequently spotted with red, and reach two to four feet in height. Leaves are triangular shaped, hairy, and rough to the touch. Flowers are green and mature into burs that are hard and covered with hooked spines.

Distribution: Found throughout the United States, but is less common on the Atlantic cost.

Habitat: Found in cultivated fields, pastures, roadsides, and around farm sites.

Control: Annual weeds, like common cocklebur, can be controlled with timely mowing and proper pasture management. Several herbicides exist that provide adequate control of common cocklebur. Most weeds are better controlled by herbicides when they are small or seedlings. Larger common cocklebur plants may need to be removed by hand pulling, as stems become woody and adequate control with mowers and herbicides will be difficult. When using a herbicide, be sure to carefully follow all grazing restrictions and other pertinent information stated on the herbicide label.

Toxin: Carboxyatractyloside with possible minimal contributions from diterpene glycosides such as atractyloside. Carboxyatractyloside is found in the seed at about 0.46% and in the cotyledons at about 0.12%. The toxin is not found in significant amounts in the mature plant.

When Toxic: Toxicity normally occurs in the spring, or during an extended, warm fall when germination occurs, and animals ingest the common cocklebur seedling, or very rarely if animals ingest the mature bur.

Toxicity: A specific toxic dose of the plant has not been reported. Carboxyatractyloside and atractyloside interfere with the ability of cells to make energy (specifically, ATP production in the mitochondria).

Signs and Effects of Toxicosis: Depression, weakness, a "tucked up" abdomen, muscle twitches, and recumbency may be seen within a few hours of eating common cocklebur seedlings. Clinical signs may progress to paddling, coma and death within a few hours to a few days as the liver damage progresses.

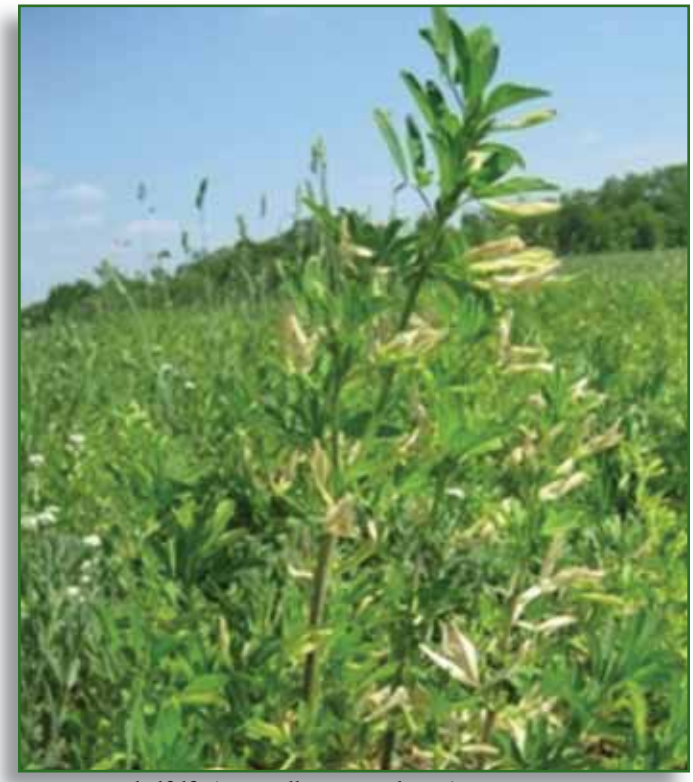
Treatment: Treatment is not always possible due to the rapid nature of the toxicosis. Activated charcoal may be given to reduce further absorption of the toxin. Muscle relaxants may be useful if the animal has muscle twitching.

Other Information: Burs of common cocklebur are considered a nuisance because they become tangled in horse's manes and tails. The burs of common burdock are often confused for common cocklebur burs. However, common burdock burs are circular with a reddish center, compared to common cocklebur burs that are oblong, brownish, and spiny (see photo).

Drought and Frost Concerns

Sorghum species

Fall colored cherry leaf



Frost injured alfalfa (note yellowing on leaves)

Fall maple leaf color

Drought Concerns

Sorghum-sudangrass has good yield potential, especially in dry years, and can be used for pasture or hay. The crop is most commonly used during times of high temperatures and drought, usually as an emergency forage for cattle. Even though sorghum-sudangrass is not commonly grazed by horses or fed in horse quality hay, it might be fed during times of drought, especially when other forage is limited.

If buying sorghum-sudangrass during a drought year, test the forage for cyanide and nitrate content before feeding it. Forage positive for cyanide should not be fed. Legume and grass hays may also be checked for nitrate concentration during a drought. Nitrates are normally found in forages, with most forages having between 100 (0.1%) to 1,000 (1%) ppm nitrate, even at maturity. Research has shown that feeding hay containing 1.5 to 2% nitrate to pregnant and non-pregnant mares resulted in clinically normal foals, even though higher than normal levels of nitrate were detected in blood samples. As a general rule, horses should not be fed hay containing more than 2% nitrate, because the safety of such forage has not been researched in horses. See "Nitrate Accumulators" fact sheet for additional information on nitrate.

Sorghum, sudangrass and sorghum-sudan hybrids, along with Johnsongrass, have also been implicated in cases of cystitis (urinary bladder inflammation), and abortion. Mares affected by cystitis may also accumulate a yellowish, sticky, granular fluid in the bladder. Death may also result from kidney damage. These grasses may also develop toxic levels of cyanide, also called prussic acid, under drought and/or frost conditions.

Frost Concerns

Some deciduous leaves can be deadly after a frost or after they have wilted due to broken branches, fall leaf shed or storm damage. Leaves of greatest concern for horses are wilted maple and prunus species, including chokecherry, ornamental almond, and cherry trees. Identify all such seasonally toxic trees on your property, and keep horses from their fallen or frost damaged leaves for at least 30 days. Even though these leaves are not commonly eaten, horses can accidentally ingest them, especially if hungry or bored. Cyanide toxicity can also be an issue after frost.

There are no reports of toxicity of horses grazing frost damaged alfalfa or clover. Cattle, however, are prone to bloat if they are allowed to graze bloat-causing legumes (i.e clovers and alfalfa), and can be more at risk when there is moisture on these legumes (i.e. dew, frost and/or rain). Frost damaged alfalfa and clovers can have higher concentrations of sugars, leading to an increase in potential for founder and colic. To reduce the chance of adverse health effects, it is recommend that horse owners wait up to a week before turning horses back onto a pasture after a killing frost.

Endophyte-Infected Tall Fescue

Vegetative tall fescue

Mature tall fescue

Scientific Name: *Festuca arundinacea.*

Origin: Introduced from Europe.

Lifecycle: Perennial.

Identification: There is no physical or visual way to tell the difference between endophyte-infected tall fescue and endophyte-free tall fescue with the naked eye. Tall fescue is a bunch grass. Leaves are numerous, dark green, and shiny. Leaves are smooth on the under surface, but rough to the touch on the upper leaf surface because of the ribbed veins. Endophyte-free tall fescue can be fed to or grazed by horses.

Distribution: Commonly found throughout the United States and Minnesota.

Habitat: Commonly found in pastures and hay fields, and can be grown on poorly-drained soils.

Control: Removal of endophyte-infected tall fescue will most likely require a major pasture or hayfield renovation. There are no herbicides available to selectively remove endophyte-infected tall fescue from grass pastures or hay fields while keeping beneficial grass species. There are herbicides available to remove all grass species from alfalfa or clover pastures or hay fields. The best control is to not plant endophyte-infected tall fescue.

Toxin: The endophyte (an organism that lives within a plant) grows symbiotically with tall fescue and has a positive influence on fescue growth, including defending the plant from pests. The endophyte is not externally visible with the naked eye. Unfortunately, the endophyte induces toxicity in horses. Fescue infected with the endophyte *Neotyphodium coenophialum* (formerly known as *Acremonium coenophialum*) is known to produce many ergopeptide alkaloids. Most of the toxic effects of fescue are now attributed to ergovaline, a specific ergopeptide alkaloid.

When Toxic: Toxic when eaten fresh and when dried in hay. Ergovaline concentrations are usually highest in the seeds and leaf sheaths. Concentrations in the stems and leaf sheaths tend to peak in late June and then decline as seeds develop. Ergovaline concentrations may be higher after nitrogen fertilization and lower during heavy grazing.

Signs and Effects of Toxicosis: Many clinical syndromes have been associated with endophyte-infected fescue including reproductive loss, fescue foot, summer slump, and fat necrosis. Reduced conception rates, prolonged gestation, weak foals, stillbirths, abortions, thickened placentas, and lack of milk production in mares have been observed in horses fed endophyte-infected fescue. Fescue foot is the loss of feet, ears, tails, or any combination of these due to the vasoconstrictive effect of ergovaline on blood vessels. Summer slump and fat necrosis are rare in horses.

Treatment: Many treatments have been investigated for these syndromes including selenium, copper, thiamine, dopamine antagonists such as metaclopramide, or dopamine agonists such as bromocriptine. The best approach is to avoid endophyte-infected pasture or feed endophyte-free hay. Pregnant mares should be removed from endophyte-infected fescue 45 days before foaling.

Recommendations: Most fescue in Minnesota is endophyte free, but labels of pasture mix containing tall fescue (and other fescues) should be checked. Endophyte infected or enhance fescues should not be planted in Minnesota horse pastures. Endophyte free fescues are commercially available.

Other Information: Tall fescue is adapted to a wide range of soil, including wet soils, is somewhat tolerant of continuous grazing, and has excellent fall productivity. Tall fescue can have marginal winter hardiness and low palatability.

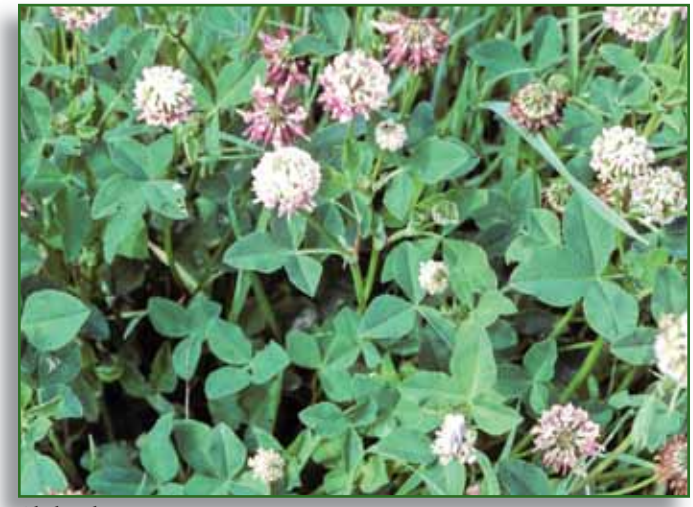
Feeding Clover

Red clover

Red clover (showing "V" mark)

White clover

Yellow sweetclover



Alsike clover

Scientific Names: Red clover *(Trifolium pretense)*, White clover *(Trifolium repense)*, Alsike clover *(Trifolium gybridum)*, and Sweetclover *(Melilotus species)*.

Origin: Red clover *(Trifolium pratense)* was introduced from Asia and Europe; white clover was introduced from the Mediterranean and western Asia; sweetclover was introduced from Russia; and alsike clover was introduced from Europe and Asia.

Lifecycle: All clovers are perennials, reproducing by seed, with white clover reproducing by seed and stolons (above ground reproductive stems).

Identification: Red clover: trifoliate leaf (three leaflets) that is non-serrated (smooth) and hairy. Most leaves have a white "V" mark. Entire plant is usually hairy with reddish to purple colored flowers. White clover: trifoliate leaf with serrated (toothed) leaf edges, extending to the base of the leaf. Most leaves have a white "V" mark, and are shiny on the underside, with white flowers. Sweetclover: trifoliate leaf with serrated leaf edges, extending to the base of the leaf, with white or yellow flowers. Alsike clover: trifoliate leaf with finely serrated leaf edges, extending to the base of the leaf. Leaves lack "V" mark, and are dull on the underside with white flowers.

Distribution: All clover are commonly found throughout the United States.

Habitat: All clovers are found in pastures and ditches. Clover is a common component of many pasture and hay mixes. Clover is also commonly used by transportation departments for ditch or roadway.

Use: Clover can be a desirable feed source for most horses whether used in pasture or in hay because it provides useful energy and acceptable protein and fiber. Clovers can occasionally be infected with mold, causing slobbers, photosensitivity, and bleeding. Even with these potential problems, clover is still considered a useful forage for horses.

Control: Only moldy clover causes toxicity problems with horses. In very wet years or periods of high humidity, fencing horses out of clover rich pastures is probably the best control strategy. To decrease the chance of mold, you can increase air movement by mowing, thinning clover stands, or improving drainage. When using clover for hay, keep in mind that clover, especially red clover, takes longer to dry than other forage species. If you wish to remove clover from your pasture or hay field, there are several effective herbicides available. When using a herbicide, be sure to carefully follow all grazing and harvesting restrictions and other pertinent information stated on the herbicide label.

Slobbers

Growth of mold on clover is occasionally encountered. Two mold problems are generally associated with red, white, and alsike clovers. The molds are associated with weather above 80°F and humidity above 60%. The most well characterized mold problem is "slobbers". Horses can literally fill several 5 gallon buckets full of saliva in one day. This condition is caused by slaframine, which is produced when red clover is infested with the mold *Rhizoctonia leguminicola*. The mold is generally a rust color seen on the upper side of the leaf. This mold normally "runs its course" or lasts about 2 to 4 weeks, depending on weather conditions.

Photosensitivity

The second problem in these clovers, Black Blotch Disease, is not as well characterized, but has been reported in Minnesota, Washington, and areas of Canada. Black Blotch Disease of clover, and other legumes, is caused by infestation with *Cymodothea trifolii* mold. The mold literally causes black blotches to occur on the underside of the clover leaves, usually closer to the ground where the humidity is highest. Horses ingesting clover with Black Blotch Disease have been known to develop excessive sunburn, or photosensitivity, which is really a thickening and reddening of the white areas of skin due to liver damage. Black or dark haired horses can experience liver damage even if the sunburn is not visible. Research has shown that photosensitive reactions can also occur in horses grazing alfalfa infested with *Cymodothea trifolii*.

Bleeding

A third mold condition affects a different clover, white and yellow sweetclover. These clovers are not common in pasture mixes, but are more frequently seen along roadways and older hay fields. The problem arises not from clover in pastures, but if sweetclover is harvested for hay and then molds. An unknown mold converts the naturally occurring cumarol in the sweetclover to dicumerol, a blood thinning drug. Horses may bleed if moldy sweetclover hay is a substantial amount of their diet over several days. Dicumerol clears quickly. Taking the horse off the hay is the best treatment. Injections of vitamin K or blood transfusions may be necessary in extreme bleeding cases, but feeding a natural source of vitamin K, like fresh alfalfa hay, is usually all that is necessary. Crimping sweetclover at cutting reduces, but may not entirely eliminate the potential for molding. Crimping usually results in reduced drying times.

Field Horsetail and Brakenfern

Field horsetail

Brakenfern

Field Horsetail

Scientific Name: *Equisetum arvense.*

Also Known As: Scouring Rush.

Origin: Native to North America.

Lifecycle: Perennial (lasting 3 or more years); reproduces by creeping rhizomes (underground stems) and spores (reproductive structures).

Identification: Hollow, wiry, jointed stems, with 8 to 12 small, scale-like, whorled leaves. No flower is produced; instead, a cone-like structure is borne at the top of the stem. This cone-like structure houses millions of spores. Plants are 2 to 4 inches in height.

Distribution: Found throughout most of the United States, with the exception of the southeastern United States.

Habitat: Found in moist to wet soils, usually sandy or gravely in texture.

Control: Horsetail is a relativity slow-spreading, non-competitive weed but, once established, field horsetail is very difficult to control. Very few herbicides provide adequate control and tillage may actually increase plant density by spreading the rhizomes. Correcting drainage problems or fencing horses out of wet areas populated with horsetail may be the best control measures.

Brakenfern

Scientific Name: *Pteridium acquilinum.*

Origin: Native to North America.

Lifecycle: Perennial, reproduces by rhizomes and spores.

Identification: Fern-like leaf with plants reaching 1 to 4 feet in height. Spores are borne on the underside of each leaf in brownish bands.

Distribution: Found throughout the United States.

Habitat: Found in open pastures and woodlands, particularly on acid soils.

Control: Some herbicides exist for suppression and control of brakenfern but multiple treatments may be required. When using a herbicide, be sure to carefully follow all grazing restrictions and other pertinent information stated on the herbicide label.

Both Plants

Toxin: Brackenfern has several toxic syndromes in different species. This publication focuses on the neurological syndrome in horses. Brackenfern contains a type I thiaminase enzyme. This enzyme both destroys thiamine and creates a thiamine analog. The analog appears to be absorbed and then interferes with a number of thiamine-requiring physiological processes. Field horsetail also contains thiaminase activity.

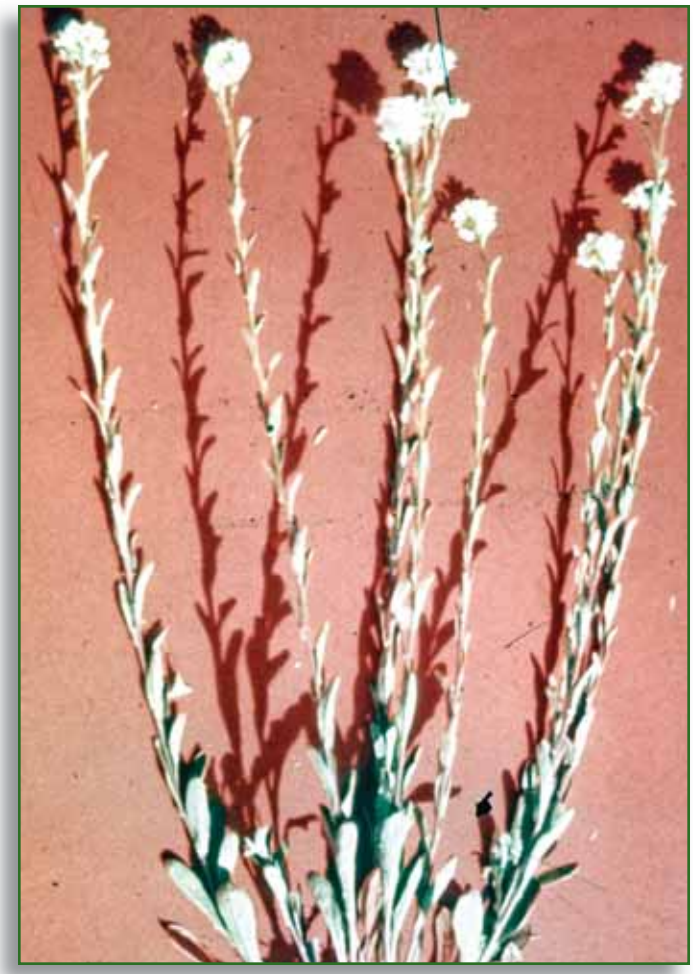
When Toxic: In both plants, the thiaminase enzyme activity is found in the plant tissues and is toxic when eaten fresh (in pasture) or dried in hay.

Toxicity: A diet comprised of 20 to 25% bracken fern or field horsetail consumed for approximately three weeks is associated with neurological signs in horses. Clinical signs may develop after a week to ten days in horses ingesting a diet of nearly 100% bracken or horsetail.

Signs and Effects of Toxicosis: Horses develop depression, constipation, and an unsteady gait usually in one to two days. Clinical signs progress to an unsteady gait, muscle twitching, going down, paddling, and seizing for a period of a week or more.

Treatment: Thiamine at 0.5 to 1 gram initially, then decreasing daily doses for three to five days.

Hoary Alyssum



Mature hoary alyssum plant

Hoary alyssum flower

Hoary alyssum in a pasture

Hoary alyssum seed head

Scientific Name: *Berteroa incana.*

Origin: Introduced from Europe and Asia.

Lifecycle: Can be an annual, winter annual, biennial, or a short-lived perennial and reproduces by seed. Hoary alyssum can spread rapidly due to the high number of seeds produced per plant.

Identification: Stems are grayish-green, hairy, one to three feet tall, with many branches near the top. Leaves are oblong, grayish-green and covered with rough hairs. Flowers are white with four deeply divided petals. Seed pods are hairy, oblong and appear to be swollen with a point on the end.

Distribution: Is commonly found throughout Minnesota, the upper Midwest, and Western States.

Habitat: Most abundant in disturbed sites but is also found in meadows and pastures and is a common weed in hay fields. It is particularly adapted to dry conditions on sandy or gravely soils. It prefers direct sunlight but can also tolerate shade.

Control: A healthy, dense stand of pasture forages can help prevent establishment or spread of hoary alyssum. Hand pulling or digging and mowing can be very effective for small infestations but should be done before flowering. There are several effective herbicides, but they may require more than one application and should be applied prior to flowering. If the weed is flowering mowing or hand pulling is recommended prior to seed production. When using a herbicide, be sure to carefully follow all grazing restrictions and other pertinent information stated on the herbicide label.

Toxin: Unknown.

When Toxic: Hoary alyssum is toxic when the fresh plant is grazed in pasture, or the dried plant is eaten in hay. Although, most horses prefer other, more palatable forages over hoary alyssum when on pasture, hoary alyssum toxicosis in pastured horses has occurred. Most hoary alyssum toxicosis occurs when horses ingest hoary alyssum infested hay.

Signs and Effects of Toxicosis: Most horses react differently to hoary alyssum toxicity. Signs are usually observed 12 to 24 hours after the horse ingests hoary alyssum. Just under 50% of horses ingesting hoary alyssum will show clinical signs of edematous, swelling of the lower legs commonly called “stocking up”, a fever of 103° F or higher, warm hooves, pronounced digital pulse (often called laminitis), stiffness of joints, reluctance to move, a “camped out” stance, and vary rarely death. Death was not observed in any horses dosed experimentally with hoary alyssum, although all other clinical signs were observed. In most cases, mild "stocking up" has been observed in horses on pasture or in those ingesting hay with less than 20% hoary alyssum. However, more severe clinical signs have been observed in horses ingesting hay with more than 20% hoary alyssum. These have tended to be rodeo, race, dressage or other physically fit horses. Horses with laminitis may rarely have rotation of the coffin bone through the hoof, especially if transported during the acute phase of toxicosis. Transporting horses during this phase is not recommended.

Treatment: Clinical signs normally subside with supportive treatment 2 to 4 days following removal of the weed source. Recovery of animals with clinical evidence of founder may take several more days. However, horses may not return to full performance fitness for a few months after onset of clinical signs.

Recommendations: Hay containing 20% or more hoary alyssum should not be fed to horses.

Maple

Red maple

Fall leaf color

Maple leaf

Wilted maple leaves in a horse pasture (wilting caused by storm damage)

Scientific Name: *Acer* species.

Origin: The genus *Acer* consists of about 115 species of trees and shrubs widely scattered throughout the Northern Hemisphere. Of the 13 maples native to the United States, four are very common. They include sugar maple *(Acer saccharum)*, red maple *(Acer rubrum)*, silver maple *(Acer saccharinum)*, and boxelder *(Acer negundo)*.

Lifecycle: Maples reproduce by seed and vegetatively by stump sprouts. Diameter and height varies by species as does longevity.

Identification: Leaves are deciduous (drop in fall) and are lobed with toothed margins.

Distribution: Most maple species are found throughout the eastern portion of the United States and Canada.

Habitat: Some species prefer wet sites; others grow mainly on uplands. Best growth is made on moist, rich, well-drained soils. Maples are a major component of many northern temperate forests.

Control: Maple trees in horse pastures should not be cut down, but branches should be kept out of reach of horses (i.e., trimmed above their reach). Young or small maple trees should be fenced for protection. Horses should be fenced out of areas where wilted maple leaves are plentiful. Wilted leaves can be a result of fall leaf shed, trimming, frost, and/or wind or storm damage.

Toxin: The toxin responsible for the red blood cell damage has not been identified, although a number of chemicals have been investigated. Most experimental studies have been done using the leaves from Red maple *(Acer rubrum)*. The authors are aware of toxicosis in horses after ingestion of other species of *Acer* as well.

When Toxic: Ingestion of dried or wilted, but not fresh, maple leaves is associated with the toxicosis. Although dried leaves may remain toxic for 4 weeks, they are not generally believed to retain toxicity the following spring. Toxicosis normally occurs in the autumn when normal leaf fall occurs. Although studies indicate that leaves collected after September 15 are more toxic, the authors are aware of cases of toxicosis in horses due to wilted leaves after summer storms.

Toxicity: Red cell damage has been reproduced in horses ingesting 1.5 to 3 pounds of dried leaves per 1,000 pounds of body weight.

Signs and Effects of Toxicosis: Horses are the only species for which maple leaf toxicity has been reported. Horses are often depressed, lethargic, and anorexic with dark red/brown urine after the first day of ingestion. They may progress to going down with labored breathing and increased heart rate before death.

Treatment: Activated charcoal followed by mineral oil may be given soon after ingestion. Fluids and whole blood transfusions may be required in many cases. Vitamin C, non-steroidal anti-inflammatory drugs, and corticosteroids may be used in some cases.

Mouth Blisters

Foxtail with seed heads

Hay containing a high percentage of ticklegrass (note dark or purple areas)

Foxtail seeds

Microscopic barbs of Ticklegrass

Sandbur

Ticklegrass embedded in a horse's mouth

Species and Scientific Names: Foxtail *(Seteria* species*)*, Sandbur *(Cenchrus* species*)*, and Ticklegrass *(Agrostis hyemalis)*.

Origin: Foxtail was introduced from Europe and Asia; sandbur was introduced from Africa, Europe, and Australia; and ticklegrass is native.

Lifecycle: Foxtail and sandbur are annuals reproducing from seed. Ticklegrass is a perennial.

Identification: Foxtail seed heads resemble a bottle brush and are green or light green in color. Sandbur burs (seeds) are barbed, slender, and often have a purple tinge. Ticklegrass seed heads are green to purple in color and shiny, turning tan at maturity. Branches of the flowers are rough to the touch.

Distribution: Foxtail is found through out the United States. Sandbur is found in the central part of the United States, along the north and mid-Atlantic States, and in distinct areas of the western United States. Ticklegrass is found from the Dakotas south to Texas, encompassing most of the central and eastern United States.

Habitat: Foxtail and sandbur are commonly found in recently disturbed soils and sandy areas. They are common in pastures and hay fields after periods of drought or new seeding. Ticklegrass is found in dry or moist soil in woods, fields, bogs, meadows, roadsides, waste areas, stream banks, shores, and also in upland habitats, often where alkaline (basic) soils persists.

Control: Mowing is a relatively effective method of control for all three grasses, since timely mowing can minimize or eliminate seed production. In a grass pasture or hay field, there are no herbicides available for control of foxtail, sandbur, or ticklegrass. Spot treatment with glyphosate is an option, but good pasture management practices will help reduce or eliminate weed populations.

Toxin: These plants are not listed because of a chemical toxin but rather due to the physical trauma to the mouth, gastrointestinal tract, and occasionally skin of horses from due to physical contact with the plants.

When Toxic: When ticklegrass, sandbur, and/or foxtail are eaten by horses, usually in baled hay or rarely fresh forage, the microscopic barbs on the seed heads or stems may become embedded into the soft tissue of the lips, mouth, gums, or lower gastrointestinal tract. The leaves (vegetative growth) of sandbur and foxtail do not result in physical trauma and can be grazed, but are not considered recommended forage species.

Signs and Effects of Toxicosis: Horses may have blisters or ulcers on the lips or mouth after ingestion of these plants. Animals may develop weight loss due to gastrointestinal tract damage if large amounts of the plants are ingested for long periods of time.

Treatment: Removal of the plant source and supportive treatment of the blisters or ulcers such as rinsing with water or topical cream.

Other Information: Hay containing moderate amounts of foxtail and sandbur seed heads, and/or ticklegrass seed heads and stems should not be fed to horses.

Nitrate Accumulators

Curly dock

Redroot pigweed

Common lambsquarter

Sorghum species

Species: Common Lambsquarter *(Chenopodium album)*, Redroot Pigweed *(Amaranthus retroflexus)*, Curly Dock *(Rumex crispus)*, and Sorghum-sudangrasses *(Sorghum* species*)*.

Origin: Native to North America (red root pigweed), introduced from Europe (common lambsquarter, curly dock) and Africa (sorghum-sudangrass).

Lifecycle: Annual (common lambsquarter, redroot pigweed, sorghum-sudangrass); perennial (curly dock).

Identification: Common lambsquarter: can grow to three to four feet in height, branched, with toothed leaves that tend to have a white coating on the upper-side of leaves, especially when in the seedling stage. Flowers are small and green. Redroot pigweed: can grow to three to four feet in height, stems rough and branched. Leaves dull green and oval in shape. Flowers are green, small and prickly to the touch. Curly dock: can grow one to four feet in height, with long, wavy green leaves. Flowers are located in bunches, and turn from a greenish color to a reddish-brown color when mature. Sorghum-sudangrass: stems are erect and solid and reach a height of two to twelve feet. In many respects, the structure, growth, and general appearance is similar to corn.

Distribution: All are found throughout the United States.

Habitat: All are found in cultivated fields, pastures, and roadsides.

Uses: Sorghum-sudangrass has good yield potential and can be used for pasture or hay. The crop is most commonly used during times of high temperatures and drought, usually as emergency forage for cattle. Even though sorghum-sudangrass is not commonly grazed by horses or fed in horse-quality hay, it might be fed during times of drought when other forage is limited. If buying sorghum-sudangrass during a drought year, test the forage for excessive nitrates before feeding it.

Control: Annual weeds, like common lambsquarter and redroot pigweed, are easily controlled with timely mowing and proper pasture management. Perennial weeds like curly dock are difficult to control. Timely mowing alone may take several years before adequate control of perennial weeds are achieved. Several herbicides exist that provide adequate control of common lambsquarter, redroot pigweed and curly dock. However, multiple herbicide applications may be needed for adequate control of curly dock. Most weeds are better controlled by herbicides when they are small. Larger plants may need to be removed by hand pulling, as stems become woody, and adequate control with mowing and herbicides will be difficult. When using a herbicide, be sure to follow all grazing restrictions and other pertinent information stated on the herbicide label.

Toxin: Nitrate.

Toxicity: Nitrate in the plant is converted to nitrite in the gastrointestinal track of animals. If nitrite is absorbed in the blood in sufficient quantities it may convert hemoglobin to methemaglobin. Methemaglobin does not release oxygen to tissues, and can interfere with the animal's ability to use oxygen. Ruminate animals like cattle and sheep are reported to be about ten times more susceptible to nitrate poisoning than horses because their rumen converts nitrate to nitrite. The same reaction may take place in the cecum (hindgut) of horses but to a lesser extent. Thus, horses are generally more tolerant of higher concentrations of nitrate in forage than cattle are.

When Toxic: Nitrate concentrations of plants tend to be higher in young rapidly growing plants, those that have had nitrogen fertilization, and after cloudy days. Research has shown that feeding hay containing 1.5 to 2% nitrate to pregnant and non-pregnant mares resulted in clinically normal foals, even though higher than normal levels of nitrate were detected in blood samples.

Signs and Effects of Toxicosis: Symptoms of nitrate poisoning in horses include: difficulty breathing, bluish-colored mucous membranes, weakness, tremors, and possibly death.

Treatment: Nitrate exposure has also been associated with goiter (or hypothyroidism) because of the potential for nitrate to interfere with iodine. Offering horses iodized salt is the most practical means of preventing nitrate associated goiter.

Other Information: DHIA (320-352-2028), Dairyland (320-240-1737) and the Minnesota Veterinary Diagnostic laboratory (612-625-8787) can test hay for nitrate concentrations. See the “Drought and Frost Concerns” fact sheet for additional information on nitrate.

Oak

Newly emerging oak leaves or buds

Oak leaves

Green acorns

Scientific Name: *Quercus* species.

Origin: The oak group is one of the most important groups of hardwoods found on the North American continent. The oak genus is comprised of 500 to 600 species, and about 60 are native to the United States.

Lifecycle: Like many slow-growing trees, oaks may attain a considerable age, in some instances a maximum of 500 to 600 years.

Identification: Leaves are deciduous (drop in the fall), and often clustered at the ends of the twigs. Dead leaves often remain on the tree over winter. Acorns are nuts with a tough leathery shells that mature in one or two seasons. The oaks are classified into two groups: red and white oaks. Red oaks have pointed leaves with bristle-tipped lobes, while white oaks have rounded lobes or large regular teeth.

Distribution: Oaks are widely distributed throughout the temperate regions of the Northern Hemisphere.

Habitat: Oaks are found in nearly all upland hardwood forests. Most oaks are intolerant or moderately tolerant of shade and competition, depending on species.

Control: Oak trees in horse pastures should not be cut down, but branches should be kept out of reach of horses (i.e., trimmed above their reach). Young or small oak trees should be fenced for protection. Horses should be fenced out of areas where acorns are plentiful.

Toxin: Tannins and gallotannins have historically been reported as the toxic agents in oak toxicosis. Tannins that can be hydrolyzed are more associated with toxicity. For example, high doses of gallic acid (a gallotannin) have been associated with renal toxicity. However, all chemicals in oak that may cause toxicity have not been clearly identified.

When Toxic: The oak buds in the spring, and green acorn hulls in the autumn are associated with toxicosis.

Toxicity: The concentration of hydrolyzable tannins is highest in immature leaves, members of the black and red oak species, and immature acorns.

Signs: Animals ingesting large amounts of oak buds or acorns for two to three days to a week or more may develop anorexia, constipation, diarrhea, colic, edema of neck and abdomen, and polyuria (frequent urination). Liver damage rarely occurs in horses.

Treatment: Supportive treatment for kidney and gastrointestinal tract damage, including fluid and electrolyte therapy, may be needed for several weeks.

Other Information: The safety of a preventative feed containing calcium hydroxide developed for cattle has not been researched as a horse feed and should not be fed to horses.

Poison Hemlock and Waterhemlock

Waterhemlock roots

Waterhemlock leaves

Waterhemlock flower

Poison hemlock flowers

Poison hemlock mature plant

Scientific Name: Poison hemlock *(Conium maculatum)* and Waterhemlock *(Cicuta* species*)*.

Also Known As: Cowbane.

Origin: Native to North America (waterhemlock) and introduced from Europe (poison hemlock). Some species are grown as ornamentals.

Lifecycle: Perennial (waterhemlock) and biennial (poison hemlock). Both reproduce by seeds; waterhemlock also reproduces by tuberous roots.

Identification: Both waterhemlock and poison hemlock are two to seven feet tall, with hollow stems that are branched at the top, and often mottled with purple spots. Both smell like parsnips or parsley when leaves are crushed. Both have white flowers that are borne in umbrella shaped clusters called umbles. Specifically, waterhemlock roots and stems may produce a yellowish, fragrant oil when cut. Leaves have toothed edges and grasp the stem like a celery bunch. Poison hemlock produces a rosette of leaves near the ground in the first of growth, followed by an erect, flowering stalk the second year. Leaves have a lacy appearance and smell like parsnip when crushed. The tap root resembles a small white carrot.

Distribution: Poison hemlock is found across most of the United States, with the exception of northern Minnesota, the Dakotas, and eastern Montana and Wyoming. Waterhemlock is found from North Dakota south to Texas and east to the Atlantic, with the exception of the Gulf Coast States.

Habitat: Both species are found in swamps, lowlands, usually in water or at the water's edge (i.e. along streams).

Control: While horses do not find these plants particularly palatable, they can be accidentally ingested. These plants can be controlled with herbicides, but make sure to follow all grazing restrictions and other pertinent information on the herbicide label. If they are growing near water, herbicide options may change, or special precautions may be needed to protect the waterway. Under no circumstances should herbicides be sprayed, or allowed to drift into any waterway, pond, or stream. Plants can also be dug or pulled, but gloves should be worn when handling the plants.

Toxin: Waterhemlock contains the short chain alcohols cicutoxin and cicutol. Poison hemlock contains a number of alkaloids including coniine, N-methylconiine, and gamma-coniceine.

When Toxic: Virtually, all cicutoxin and cicutol are in the roots of waterhemlock. Because waterhemlock grows in wet areas, the roots can easily be pulled up and accidently ingested when horses are grazing. The alkaloid concentration of poison hemlock generally increases as the plant matures and is highest in seeds. The alkaloid concentration decreases after the plant dries, but can still be toxic in hay.

Toxicity: Death is reported in animals ingesting about two grams of waterhemlock root per kg body weight or about two pounds per 1,000 pound horse. Lethal doses of poison hemlock range from 0.2 to 0.8 % body weight or two to eight pounds per 1,000 pound horse.

Signs and Effects of Toxicosis: Animals are most commonly just found dead after ingestion of waterhemlock. Rarely, violent seizures are observed. In closely observed cases, anxiety and muscle twitching are noted, particularly around the lips, nose, face, and ears, followed by seizures and teeth grinding. Finally seizures become more prolonged with frothy saliva, tongue lacerations and broken bones in severe cases.

Animals develop clinical signs of nervousness, tremors, muscle weakness, incoordination, salivation, urination, and colic within an hour of ingesting Poison hemlock. Signs will progress to severe depression and recumbency. Horses often go down quietly, and may have tucked up flanks for several days after recovery. Seizures may occur, but they are less common than with waterhemlock.

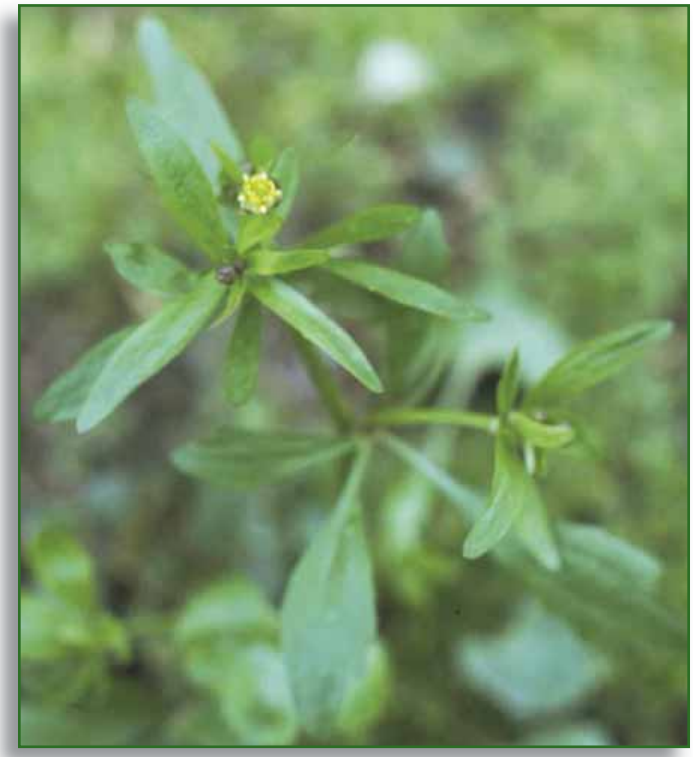
Treatment: Animals that survive for 8 hours after the onset of clinical signs are more likely to recover, unless they have complications from seizures. There is no specific antidote. Sedation of the animal may help if it can be done safely. Charcoal may be used, but is rarely practical in seizing animals.

Tall and Smallflower Buttercup

Tall buttercup

Smallflower buttercup

Tall buttercup in field



Close-up of smallflower buttercup flower

Scientific Names: Tall Buttercup *(Ranunculus acris)* and Smallflower *(Ranunculus abortivus)*.

Also Known As: Bachelor's Button, Butter Daisy, and Gold Cup.

Origin: Introduced from Europe. Some varieties are also grown as ornamentals.

Lifecycle: Tall buttercup is a perennial. Smallflower buttercup is an annual or biennial. Both reproduce by seeds.

Identification: Stems are slender, slightly hairy and branched, reaching heights of six inches to three feet. Lower leaves of smallflower buttercup are kidney shaped. Lower leaves of tall buttercup are deeply divided and hairy. Upper leaves are smaller and differ in shape. Flowers are small, yellow, and divided into 5 to 7 petals.

Distribution: Both are found throughout most of the United States, but is rarely found in western Minnesota, the Dakotas, or eastern Montana.

Habitat: Both are found in lowland meadows, pastures, and fields. Tall buttercup prefers moist soil conditions.

Control: Buttercup species are often found in overgrazed pastures, so proper pasture management will help control or eliminate it. Buttercup will not survive cultivation or tillage and prefers moist soil conditions. Therefore, plowing a field or improving drainage in an area will also help control this weed. Some herbicides exist for suppression and control of buttercup species, but multiple treatments will be required. When using a herbicide, be sure to carefully follow all labeled information and grazing restrictions.

Toxin: Protoanemonin, and a cyanogenic glycoside triglochin in some species. Most toxicity is associated with gastrointestinal tract (GI) irritation effects of protoanemonin.

When Toxic: When eaten fresh in pasture. Protoanemonin may be present or formed from the hydrolysis of the precursor ranunculin. Protoanemonin concentrations may be 1 to 2% when the plant is flowering. The dried plant is not normally toxic because protoanemonin is converted to non-irritating anemonin.

Toxicity: Toxicity is highly variable with the protoanemonin concentration of the plant. This concentration varies widely with the species, and plant growth stage. Protoanemonin concentrations are likely to be highest in the flowering plant. The dry plant, as in hay, is no longer toxic.

Signs and Effects of Toxicosis: Clinical signs generally include blistering of the mouth, skin, and digestive system. Swelling of the nose, lips, face, and skin may be observed after contact with the plant. Diarrhea and colic may occur if the plant is ingested. Tremors, seizures, and paralysis have rarely been observed.

Treatment: Remove animals from pasture(s) containing buttercup species. Supportive care for colic and diarrhea may include fluid therapy, and an analgesic (pain killer).

Weed Seeds

Corn cockle seeds

Eastern black nightshade berries

Mustard seeds

Weed seed contaminated oats

Included: Corn Cockle Seeds, Mustard Seeds, and Eastern Black Nightshade Berries.

Scientific Names: Corn Cockle Seeds *(Agrostemma githago)*, Mustard Seeds *(Brassica)* species, and Eastern Black Nightshade Berries *(Solanum ptycanthum)*.

Origin: Introduced from Europe and Asia (corn cockle and mustard) and South America (eastern black nightshade).

Lifecycle: All are annuals reproducing from seed.

Identification: Weed seeds come in many shapes, colors, and textures. Corn cockle and mustard seeds are round or oval in shape, with a dark brown or blackish color. Eastern black nightshade berries are small, round, and turn from a greenish color to a dark purple or black color when ripe.

Distribution: All are found throughout the United States.

Habitat: All are found in cultivated fields, gardens and ditches. Corn cockle and mustard are commonly associated with small grain crops, like oat. Eastern black nightshades may be found in soybeans, or occasionally hay.

Control: Weed seeds are a common problem in "bin run", unblown, or unscreened oats. Blowing or screening oats is a process that separates the smaller weed seeds and other foreign material, like straw, sand, and other foreign matter from the oats themselves. Blowing or cleaning oats is commonly practiced by commercial oat and grain sellers and feed stores. When buying or raising your own oats, make sure they are blown or cleaned prior to feeding or seeding.

Toxin: Eastern black nightshade may contain a number of solanaceous alkaloids, such as solanadine. The mustard species also contain a number of identified chemicals, including glucosinolates, particularly isothiocyanates (mustard oils). Corn cockle contains a number of steroidal saponins, including agrostemmin.

When Toxic: The seeds, compared to the plants, have the highest concentration of toxic chemical. The seeds are normally a problem when they occur as a contaminant in grain (i.e. oats or soybeans), and rarely in hay.

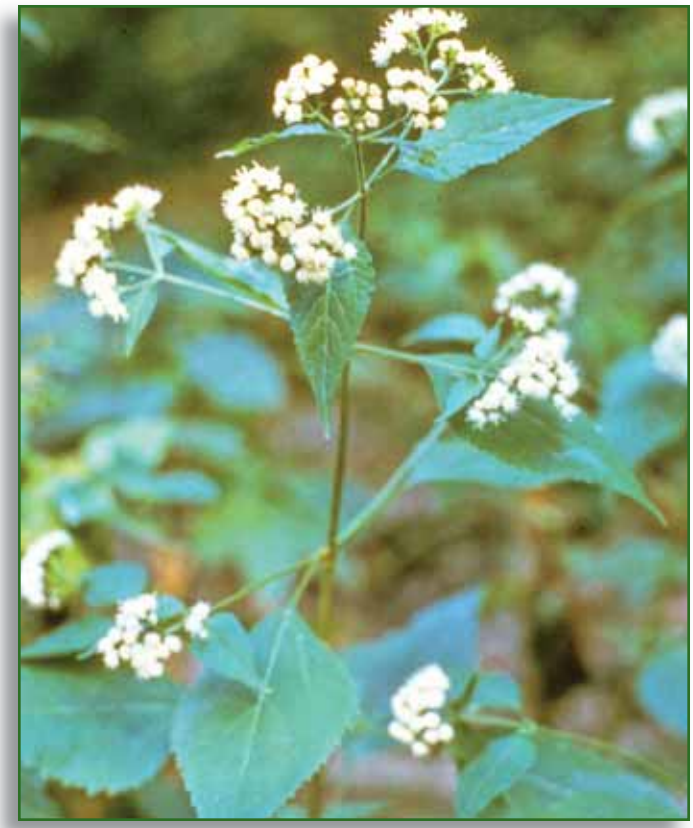
Toxicity: As little as 0.25% of body weight (or 25 pounds per 1,000 pound horse) of corn cockle seed has been shown to be toxic. Doses of 0.3 to 0.7% body weight (or three to seven ponds per 1,000 horse) of eastern black nightshade berries has also been shown to produce toxicosis and death. A specific toxic dose of mustard seed has not been identified.

Signs and Effects of Toxicosis: For each type of seed, signs and effects include reduced appetite, increased salivation, bloat, colic, diarrhea, and rarely death.

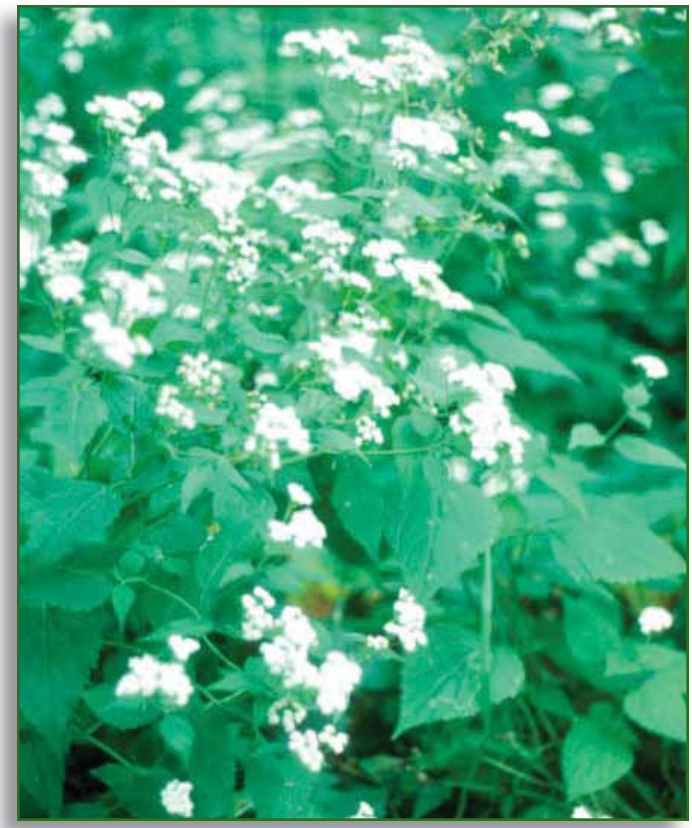
Treatment: Remove the seed source. Animals will normally need fluid therapy, often with electrolytes. Antidiarrhea treatment may be considered.

Other Information: Not only do weed seeds cause problems for horses when they are ingested, but some weed seeds can live in the soil in a dormant state for 20 or more years, causing continued weed problems in pastures and hay fields. However, most seeds germinate in the first few years after they are shed from the plant. Regardless, weed control efforts should focus on reducing or eliminating weed seed production.

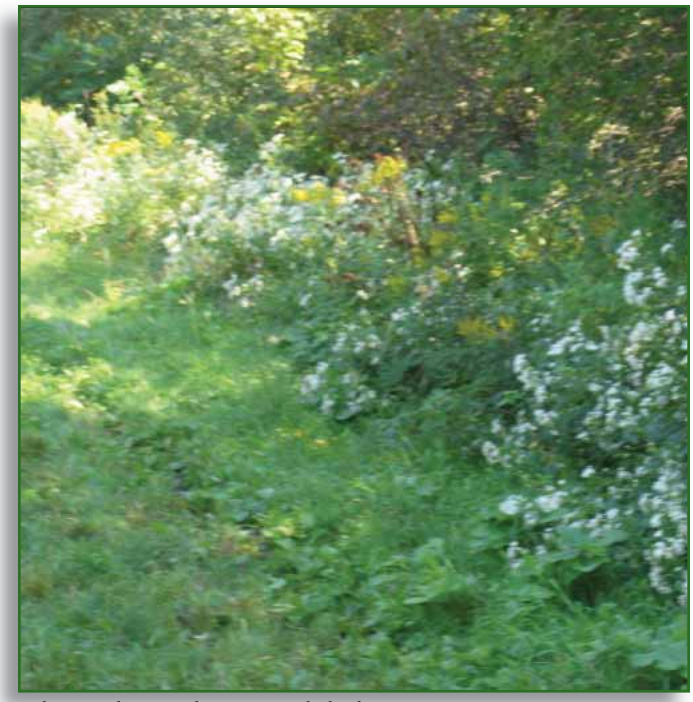
White Snakeroot



Mature plant



White snakeroot plants



White snakeroot along a wooded edge

White snakeroot prior to flowering

Scientific Name: *Ageratina altissima* (formally know as *Eupatorium ruguson*).

Origin: Native to North America.

Lifecycle: Perennial reproducing by seed and rhizomes.

Identification: Plants are one to three feet tall, smooth, erect, and branched at the top. Leaves have toothed edges and taper to a pointed end. Flowers are small, white, and arranged in clusters.

Distribution: Found from Minnesota south to northern Louisiana and east, with the exception of the Florida peninsula.

Habitat: Found in hardwoods, timber areas, woodlands, and damp and shady pastures. It grows only in shady areas.

Control: Do not allow animals to graze this plant under any circumstance. Fence off wooded areas, and provide supplemental feed (especially in the late fall or during dry conditions). Be aware that control of white snakeroot with one application of a herbicide is rarely acceptable, and multiple applications are usually needed. Exclusionary fencing, mowing, and multiple herbicide applications may be the best control options. When using a herbicide, be sure to carefully follow all grazing restrictions and other pertinent information stated on the herbicide label.

Toxin: Tremetol is a viscous oil extract of the white snakeroot plant that contains a number of chemicals including tremetone, dehydrotremetone, hydroxytremetone, and desmethylencecalin.

When Toxic: Even though tremetol concentrations decrease slowly as the plant dries, toxicoses have occurred after ingestion of hay or dry plant stalks in winter. White snakeroot is also toxic when eaten fresh.

Toxicity: Exact toxicity levels have not been reported for horses, however, horses are generally believed to be more susceptible to white snakeroot than ruminant livestock. Toxicity occurs in cattle ingesting 5 to 10% of their body weight over several days. A single dose of 5 mg/kg of body weight of green material is reportedly toxic to Angora and Spanish goats.

Signs and Effects of Toxicosis: Horses may die one to two days after ingestion of the plant. They develop difficulty swallowing, muscle trembling, and a basewide stance with their head held close to the ground. As the disease progresses, skeletal and heart muscle damage occurs, and horses are unable to stand.

Treatment: Remove horses from the white snakeroot source. Activated charcoal, followed by a cathartic, may reduce absorption or prevent reabsorption of the tremetone.

Wild Parsnip

Mature plant

Wild parsnips along a roadside

Leaf

Close-up of flowers

Scientific Name: *Patinaca sativa.*

Origin: Introduced from Europe and Asia.

Lifecycle: Biennial, reproducing by seed.

Identification: Stem is somewhat hairy, grooved, and two to five feet tall. Leaves are course, with saw-toothed edges. Flowers are yellow and arranged in an umbrella shape; appearance is somewhat like the ornamental Queen Anne's Lace.

Distribution: Found throughout the United States.

Habitat: Found in fields and roadsides, and occasionally in wet pastures.

Control: Several herbicides exist that provide adequate control of wild parsnip. However, repeated applications may be needed for control. Most weeds are better controlled by herbicides when they are small. Larger plants may need to be removed by hand pulling, as stems become woody and adequate control with mowers and herbicides will be difficult. If controlling wild parsnip by hand, be sure to wear gloves and protective clothing, as contact with wild parsnip can cause severe blistering of the skin. When using a herbicide, be sure to follow all grazing restrictions and other pertinent information stated on the herbicide label.

Toxin: Wild parsnip may contain chemicals called furanocoumarins.

When Toxic: All growth stages of the plant, when eaten fresh or dried in hay. High concentrations of furanocoumarins have been founds in the seeds as well.

Toxicity: The toxic dose of wild parsnip is not known. The toxic dose of other plants known to accumulate furanocoumarins has not been established either.

Signs and Effects of Toxicosis: Severe sunburn (photosensitivity) occurs in people and animals ingesting furanocoumarins if they are exposed to UV light after ingestion. Sunburn occurs after ingestion due to the furanocoumarin circulation in the blood vessels just below the skin. The UV light exposure is almost always from the sun. Severe sunburn occurs on the white or other light skinned areas, but not the black, brown, or other dark skinned areas, because melanin in the dark skin absorbs the UV light and prevents it from reacting with the furanocoumarins. Consequently, severe sunburn in livestock ingesting furanocoumarin-containing plants is reduced if the livestock are shaded from the ultraviolet sunlight.

Treatment: Remove the plant source. Move animals to an area where shade is available. Topical treatments can be used for the skin lesions.

Other: See the "Feeding Clover" fact sheet for additional causes of photosensitivity in horses.

Plants that Cause Death

Foxglove

Rhododendron

Yew

Oleander

Species and Scientific Names: Foxglove *(Digitalis* species*)*; Rhododendron *(Rhododendron* species*)*; Oleander *(Nerium oleander)*; and Japanese yew *(Taxus cuspidata)*.

Origin: Foxglove was introduced from Europe; Rhododendron (including azaleas) is native to North America, Europe, and Asia; Oleander is native to the Mediterranean and Asian countries, and Japanese yew was introduced from Asia. Cultivars of these plants have been developed for use as landscape plants throughout much of the United States.

Lifecycle: Foxglove is a biennial. The seedling forms a rosette the first growing season and flowers the second season. Rhododendrons are perennial shrubs or small trees that rarely propagate and spread on their own in Minnesota. Oleander is a shrub found in the Southern United States. Japanese yew is a perennial shrub or tree.

Identification: Foxglove matures to 2 to 6 feet in height. Leaves are typically oblong, hairy, and have shallow, irregularly-toothed margins. Hanging, tubular flowers can be pink, yellow, purple, or white with a spotted patterns. Most rhododendron cultivars adapted to Minnesota are moderately sized shrubs (3 to 6 feet tall) and typically flower in spring. Flowers can be red, pink, lavender, yellow, or white. Leaves are narrow, and most rhododendrons are evergreen. Rhododendron are common landscape plants in Minnesota. Oleander grows as a shrub or small tree. The leaves are thick and leathery, flowers are showy and grow in large clusters that are white or any shade of pink or red. Oleander will not over winter in Minnesota, but are common house plants. Japanese yew are fine-textured evergreens. Needles emerge a light to yellow green in spring and mature to dark green. Dense growth, fine texture, and a rich green color make Japanese yew a very popular ornamental evergreen. The species can grow into trees up to 50 feet high.

Distribution: Foxglove is commonly found throughout the United States. Under favorable conditions, foxglove can reseed and persist, and some cultivars have naturalized in Eastern Minnesota. Rhododendron and Japanese yew are commonly found throughout the United States. Oleander is a common ornamental in the Southern United States, but can not over winter outdoors in Minnesota. Oleander is grown as a houseplant or in outdoor containers during the summer months.

Habitat: Foxglove is found around homes and other sites where it was once planted as an ornamental. Foxglove performs best in slightly acidic, moist soils and can spread to nearby pastures, meadows, and ditches. Rhododendron does best in partial shade and moist, acidic soils high in organic matter. Japanese yew can grow in shade or sun and does best in fertile, well drained soil with access to consistent moisture. Rhododendron and Japanese yew are usually intentionally planted landscape shrubs. Oleandar is also an ornamental, but is considered a house plant in Minnesota.

Control: Avoid introducing foxglove as an ornamental in proximity to horses. Using gloves, pull flowering plants before seeds develop to reduce the seed bank. Several herbicides are available to help control foxglove. Avoid planting Japanese yews, and Rhododendron, where horses will have access to them. Unwanted plants can be cut down, or dug out and removed. Although plants cut to the ground generally do not re-sprout, the use of a labeled herbicide on the stump can be used. Carefully read and follow all instructions on herbicide labels. Do not feed clippings from Oleander to horses, or any other livestock.

Toxin: The toxins in Foxglove, Rhododendron and Oleander are cardenolides. Cardenolides are also referred to as cardiac glycosides. Several dozen cardenolides have been isolated from these plants including: digoxin, digitoxin, gitoxigen, and oleandrin. The chemicals associated with toxicity in Japanese yew are taxine derivatives. Taxine A and taxine B are of greatest toxicological concern, although small amounts of taxol may also be present.

Toxicity: The cardenolides interfere with sodium-potassium ATPase activity which allows a buildup of intracellular calcium in heart cells. Adverse cardiac conduction problems develop, ultimately leading to death. Concentrations of up to 480 micrograms of cardenolide per kilogram dry weight have been identified in the seed. Japanese yew toxicity in livestock has been reported after ingestion of 0.05 to 0.7 grams of fresh or dried leaves per kilogram body weight. About 0.1% body weight of leaves may be lethal to a mature horse (about 1 pound for a 1,000 horse).

When Toxic: Cardenolide concentrations are usually highest in the fruit, flowers, and immature leaves. The mature leaves of flowering plants normally have lower cardenolide concentrations. The palatability of the cardiac glycoside plants is low, so toxicosis most commonly occurs when other forage is scarse or the plants are baled in hay. Exceptions have occurred after a frost or when trimmed or pruned leaves were made available to animals.

Signs and Effects of Toxicosis: Animals may be found dead. Most animal species are susceptible to toxicity from these plants. Clinical signs of the cardenolides may be delayed for up to 12 hours after ingestion of the plant material. A profound weakness is usually observed first. Horses may not be able to raise their heads and edema of the head, lips, and eyes may develop as the toxicosis progresses. The heartbeat may be strong and slow at the initiation of signs but often becomes irregular as the toxicosis develops. Terminal seizures may be observed. Animals with Japanese yew toxicosis may show a trembling or quivering just before they drop to the ground.

Treatment: Treatment is often not possible due to the speed at which death occurs. Removal from the source of the plant and treatment with charcoal, then mineral oil is suggested. The focus of treatment is normally the heart. Atropine, lidocaine, phenytoin, and other cardiac drugs may be indicated depending on the cardiac abnormality present at the time. Digitoxin-specific Fab fragment antibodies have been developed for human use to bind cardenolides in serum.

Other Information: Be able to identify these plants and exercise extreme caution when pets (and humans) are in the vicinity of these plants, especially oleander. These plants should never be placed where animals can have contact with them. Extra care needs to be taken in cases where leaves can fall into a pasture. Decorative Japanese yew wreaths should not be placed on stall doors or fences.

Glossary

Adrenergic – portion of the nervous system that is librated, activated by or involving adrenaline (epinephrine) or an adrenaline like substance.

Agonists – drug or compound that binds to a cell receptor and stimulates a response similar to the action of the naturally occurring compound.

Alkaloid – an organic base containing Nitrogen and often Oxygen found primarily in seed plants.

Analog – compound that is structurally similar to another but differs slightly in composition.

Annual – a plant that completes its lifecycle in one year (i.e. germinates, grows, flowers, reproduces, and dies).

Antagonists – a drug or compound that binds to a cell receptor and blocks a response (opposite of agonist).

Antibodies – a protein used by the immune system to identify and neutralize foreign objects like viruses.

Antigen – a foreign substance that causes the immune system to respond with an antibody.

ATPase – the function of ATPase is to release energy and transport it across membranes in organisms.

Biennial – a plant that completes its lifecycle in two years. The first year it produces a cluster of leaves close to the ground (called a rosette), and the second year is produces seed.

Blowing – the process of using fans (or similar equipment) to mechanically clean (removing weed seeds and other foreign matter) oats.

Carthartic – laxative or agent that causes emptying of bowels.

Corticosteriods – a steroid hormone made by the adrenal cortex. Cortisone, cortisol, hydrocortisone and others are all corticosteroids.

Cotyledons – first pair of leaves or seed leaves appearing on broadleaf plants. Cotyledons are not visible on mature plants as they die shortly after the plant emerges.

Cowbane – another term for hemlock.

Cultivar – a plant bred for a specific trait to be used for agronomic, horticultural, or ornamental purposes. For example, there are many cultivars of rhododendron, each having a slightly different flower color, size, and/or leaf shape.

Crimping – crushing the plant stem. Crimpers are installed on most hay mowers to decrease drying time.

Cyanogenic Glycoside – a glycoside (a molecule containing sugar) capable of releasing cyanide (a poison).

Edema – swelling.

Endophyte – an organism that lives within a plant.

Fab Fragment – the region on an antibody that binds to an antigen.

Heartwood – wood that has died. Heartwood appears as a discolored circle, usually in the center of the tree or shrub. Heartwood is usually much darker than living wood.

Herbicide – chemicals used for killing or inhibiting the growth of plants.

Hydrolyzed – the addition of a water molecule.

Inflammation – the body's response to injury or irritation. Redness, swelling, heat, and pain occur.

Kilogram – 1 kilogram (kg) = 2.2 pounds (lb) or 1,000 pounds (the weight of the average horse) = 454 kilograms.

Laminitis – inflammation of the area of the hoof that contains nerves and blood vessels.

Legume – a plant whose seed opens along two sides. Legumes are also known for their ability to fix atmospheric nitrogen. Examples of legumes include peanut, alfalfa, and clover.

Neurological – relating to the nervous system.

Palatable – easily eaten, tasteful or delicious.

Perennial – plants that live for two or more years.

Polyurina – frequent urination.

Precursor – a substance or compound from which a second substance or compound is formed.

Recumbent – unable to rise or stand.

Renal – relating to the kidneys

Ruminants – any hooved animal that digests food in two steps, first by eating raw material and then by regurgitating it. Examples of ruminants include cattle, sheep and goats.

Serum – thin, yellow, liquid portion of blood that remains after clotting. It contains no red blood cells, platelets, or fibrinogen.

Screening – the process of using screens (or similar equipment) to mechanically clean (removing weed seeds and other foreign matter) oats.

Spores – reproductive structures of may plants, algae and fungi, including field horsetail and brakenfern.

Symbiotically – a close association between two different types of organisms that usually results in a positive beneficial for one or both organisms.

Temperate – latitudes of the globe that lie between the tropics and the polar circles and experiences climate change during the year. The northern temperate zone (which includes Minnesota) extends from the Tropic of Cancer to the Arctic Circle.

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