

TECHNICAL NOTES

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The following information on important poisonous plants in the Northwest was developed by Dr. Ben F. Roche', Jr., Associate Professor, Forestry and Range Management, Washington State University, Pullman, Washington. It was issued in February, 1968.

A. L. Oleson
State Soil Conservationist

ARROW-GRASS (Triglochin maratima)

(Arrow-grass Family)

Arrow-grass, known as sourgrass and goosegrass, is a perennial herb somewhat grass-like but not a true grass. It is a monocot with thick rush-like leaves, all basal, half cylindrical, narrow and linear with broad sheaths at the base. The plant produces these leaves in bunches 6 to 12 inches high. It may in some instances be mistaken for members of the wiregrass group (Juncus spp.).

The habitat adaptability of this plant permits wide distribution. The major requirement seems to be moisture. In the Northwest the species occurs on the salt marshes near the coast and in the interior on alkaline soils; also along sloughs, in wet meadows and seeps. It will more often than not be associated with moisture-loving grasses and sedges.

Cattle and sheep are readily poisoned by this plant. Deer and other game animals are sometimes reported as killed by eating arrow-grass. Although foraging animals may graze this plant in meadows for years without loss, heavy losses of livestock may occur on meadows after mowing. The arrow-grass is prominent in the second growth of the meadow vegetation. Another common time of poisoning is during drought years or following unseasonable frost. The poisonous principle is hydrocyanic acid which seems to be concentrated by the wilting of the plant. Hence, drought and a drop in moisture content or frost and the following wilted condition fosters animal losses.

Characteristic symptoms of poisoning are a very rapid or slow and deep breathing, trembling, blue lips and tongue and/or nervousness followed by intermittent spasms and finally by death.

The most acceptable means of controlling this source of animal loss is management. Toxicity seems to increase with a reduction of moisture (drought in the flood lands). Stock should be off known infestations by that time. Such areas can be drained, cleaned by cultivation, cropping, etc., and reseeded to advantage.

BRACKEN FERN (Pteridium aquilinum)

(Fern Family)

Bracken fern, known as bracken or brake fern, is represented in the West by the variety Pubescent. The leaves are large, to 4 feet long, much divided and somewhat triangular in outline. The main leaf divisions (pinnae) are numerous, divided and usually compound. The smallest leaf divisions (pinnules) have their margins entire, notched, cleft or sometimes twice divided. It is characteristic of this plant to produce one leaf stalk or frond each year. These develop from underground root-stock which is cord-like, woody, and dark colored. These roots may be used to estimate the age of the infestation or of a specific clone by accepting the one-frond-scar-per-year concept.

The habitat preference of bracken fern seems to tie to the fertility of the soil with the moisture range varying from moist to fairly dry. It may occur underneath as an understory in timber (Douglas-fir zone) or it may occur in parks, natural openings or in those created by the removal of timber. While cattle are normally considered susceptible to the poisonous properties of bracken, it has been substantiated as toxic to horses and to sheep. The greatest losses seem to occur in seasons of short feed or in situations wherein a major portion of the feed is of hay highly contaminated with bracken fern.

All aerial portions of the plant are considered toxic and the symptoms from its use run about as follows: high temperature, difficult breathing, salivation, nasal bleeding, and the general condition known as fern staggers.

There are at the present time no practical means of controlling this plant while using the site as a major forage-producing one. No chemical is recommended today but there are herbicides in test which appear to have the properties needed to do the job at economical rates. In the meantime it would appear that this plant is a normal part of community succession on disturbed areas (the early occupants of an area returning to timber).

CREEPING AND TALL BUTTERCUP (Ranunculus repens and R. acris)

(Crowfoot Family)

This is a large genus of perennial and annual herbs. The stem leaves are alternate, palmately-veined (veins like fingers on the hand), either with continuous or entire edges, lobed edges being dissected as are fingers. The basal leaves are frequently distinctly different from the stem leaves. The flowers may be as solitary individuals on long stems or they may be in corymb-like clusters. The sepals are green and usually five in number; the petals are a bright waxy yellow and may be five in number or they may vary in number on individual plants or between plants.

The key to identification is the tremendous number of spirally-arranged stamens (female part of the flower). These stamens are on a conical-type receptacle or base. The seed in that position produce a head which, in many instances, appears as a small bur.

The habitat of these plants is wetland. The land does not actually have to be flood land, but it should retain sufficient moisture to support a plant as typically shallow-rooted as the buttercups are. The buttercups in such a habitat are extremely competitive for surface. Their success may be due to the utilization of competitive plants by foraging animals while avoiding the buttercup species.

The avoidance, as indicated above, is intentional, due we believe to the oil which may be present in the plant which, while not highly toxic, will cause blisters, lesions, and so forth on the mouth parts of the feeding animal. The entire mouth may be irritated to the extent that it is a fiery red rather than being a normal color. The material which produces this irritation is believed to be an unstable compound in the growing buttercup known as Protoanemonin. This is an unstable compound, hence there probably is no danger from the inclusion of buttercup in hay. Symptoms, in addition to the irritation of the mouth parts, may be salivation, diarrhea, signs of abdominal pain, depression, excitement, blood-stained urine and/or blindness. In severe cases animals have been reported to die following convulsions. Post-mortem examinations of such animals reveal a similar irritation coupled with lesions throughout the digestive tract, particularly in the small intestine.

The buttercups are more susceptible to the MCPA formulations than they are to the 2,4-D formulations. They are difficult to wet, hence large amounts of water should be used as a carrier in combination with a good wetting agent. The treatments for best results should be made prior to the flowering of the buttercup. The tall buttercup (Northwestern Washington) is easier to kill than is the creeping buttercup (West-Central Washington). For that reason, tall buttercup can be controlled with less MCPA and hence with less detriment to the white clover component of the pasture than can the creeping buttercup. The creeping buttercup normally requires 2 pounds or more of the active ingredient to do the job. That amount of MCPA will essentially eliminate the white clover although it normally reseeds.

CHOKECHERRY (Prunus virginiana)

(Rosaceae Family)

Chokecherry is an erect, leafy shrub or small tree which is rather common on the western ranges. The flowers are white, to 1/2 inch in diameter, stalked, and numerous in elongated (2 to 4 inches long) showy, dense clusters (racemes) at the ends of leafy branches. The chokecherry (drupe) is globe-shaped, about 3/8 inch in diameter, on a hairless stalk and is purple or black, juicy, sweet, or slightly astringent (one-seeded). The

leaves are alternate, deciduous, one to three and one-half inches long, pointed at the tips and finely sawtoothed along the edge, dark green and hairless above, somewhat lighter green and hairy below.

Chokecherry may be found in the foothills range of the ponderosa pine zone or adjacent thereto. They grow in sunny, moist, or even relatively dry situations; the largest specimens usually being associated with willows, alders, aspen and dogwood, along the streams and open valleys or in sparsely timbered, warm, sunny canyons. They also occur about springs, seeps, and other moist places but pure brushy stands are largely limited to moist or well-drained slopes or sandy flats. They frequently do well on rocky talus slopes and about rimrocks.

The poisonous principle in chokecherry is hydrocyanic acid. This plant is commonly grazed and is considered to be fair forage for sheep and wildlife under normal conditions. It does, however, poison all classes of livestock, especially cattle, following an alteration of the forage, particularly by frost. It, and other species containing hydrocyanic acid, becomes more dangerous under conditions of frost or drought or with a heavy utilization of tender new shoots. One report indicates that from feeding trials the following amounts were effective as indicated per 100 pounds of live weight: 3.23 oz. caused slight poisoning; 3.5 oz. caused severe sickness followed by recovery; 4.3 oz. caused death. After late summer (August 28th) 1 pound per 100 pounds of live weight produced no toxic symptoms.

The symptoms vary with condition and stock: (1) The so-called slow poisoning, which may occur when sheep feed on chokecherry without taking sufficient water, the dry leaves do not liberate poison fast enough to kill the sheep, but as soon as they drink water, they may die. They may show poisoning so quickly after drinking that one thinks the water is poisoned. (2) It may be one to two days prior to the symptoms becoming noticeable. (3) Rapid poisoning may occur when animals eat chokecherry leaves which are moist. In such cases the animal may and generally does die within an hour.

Symptoms: animals are restless, run, walk with frequent stops; muscular control is lost and the animal may totter and fall. Very rapid or slow and deep breathing with trembling is common; so are the blue lips and tongue of the hydrocyanic poisoning.

Chokecherry is relatively well controlled by 2 pounds of 2,4,5-T per acre applied during the flowering stage. Several successive treatments may be required to completely eliminate the stand.

COCKLEBUR (Xanthium commune)

(Compositae Family)

Cocklebur, known as clotbur and/or sheepbur, is commonly found on farm land or the drainages adjacent thereto. It is an annual with stout stems, spreading branches and extremely rough pubescence. The plant will vary in height, dependent upon soil fertility, moisture and time of germination, from 2 inches to 6 feet. The stems, rough, as is the rest of the plant, are angular and frequently red-spotted. The leaves are large and tend to be somewhat triangular in outline, although the edges may be dentate or somewhat lobed. The seeds (two) are enclosed in an oblong bur, from 1/4 to 1 inch long, that is covered with numerous hooked prickles. These burs are common in the tails of animals moving through infested areas.

Cocklebur, though characteristically noted by its bur and the fact that it readily entangles itself with hair or wool, seems to move primarily by water. The major zones of habitation are the wetlands or more specifically the flood lands adjacent to water courses. The burs move with the water, become saturated and sink or eddy prior to saturation and germinate as the water recedes. The differential rate of water recession varies the time of germination (spring 'til summer) and hence the stage of growth of the cocklebur on relatively small areas.

The poisonous principle in cocklebur is a glucoside (hydroquinone). The period of maximum toxicity is the seedling state of the plant. The poison is concentrated in the seed which, protected by a bur, is not consumed. However, with germination the poison is distributed throughout the seedling plant. Swine, sheep and cattle are susceptible with swine the most commonly poisoned.

The symptoms of cocklebur poisoning are listed as: depression, nausea and vomiting, rapid and weak pulse, and low temperature. Spasmodic movements may or may not occur with or preceding death. The symptoms generally appear within 24 hours after the plants have been eaten and usually continue for a few hours.

Cocklebur in the seedling stage is extremely sensitive to the 2,4-D materials. One should remember, however, that the two seeds in the individual pod have seed coats of differential permeability, hence the one which germinates and is killed with 2,4-D may be replaced later that year or early the following year by a second plant from the same seed pod. For that reason a single application is not likely to eliminate the infestation even though the plant is an annual and highly susceptible.

COCKLES (Agrostemma species--corn cockles and
Saponaria species--cow cockles, and soapworts)

(Chickweed or Pink Family)

These are smooth, opposite-leaved plants with terminal flowers normally in cymes. The key to their identification is the combination of opposite leaves, smooth stem (in most instances), and the fact that the leaves are almost without a leaf stem (petiole) appearing in many instances to completely encircle the stem with their bases. The stem may also be swollen at the point of leaf attachment. Also important in the identification of these plants is a flower structure in which a group of sepals (calyx) encase the petals or corolla. This calyx is ribbed. The number of ribs or nerves thereon is used to separate related species. The petals unlike the sepals are individual; not forming a tube. They vary in color from white through pinks to reds.

The habitat is extremely variable. The weed group (cockles) includes annuals that are commonly found in grain fields and perennials, the soapworts, moved as ornamentals and likely to be found almost anywhere. The annual species in the grain fields have increased tremendously in the last fifteen years due directly to their tolerance of 2,4-D and the removal of other competitive broadleaved weeds by the 2,4-D program.

The toxicity seems to be restricted to the seed. In the case of the corn cockle, European research indicates that a lethal dose to cattle is 1/10 to 25/100 of 1 percent of the animal's weight in ground seed or about twice that amount eaten as whole seed. In the case of the cow cockle or bouncing bet, Kingsbury in his book "Poisonous Plants of the United States and Canada" reports as reference No. 801 personal correspondence with Huffman which indicates that the seeds of the plants are capable of killing sheep within four hours if fed in an amount equal to 3 percent (dry weight basis) of the animal's weight.

The reports have indicated that toxicity symptoms are similar for the group. These symptoms are primarily severe gastro-enteritis with cases of acute poisoning being reduced in the cases of hogs due to their ability to vomit. In the case of poultry fed on screenings, where 2/10 to 5/10 of 1 percent of the body weight of the poultry was fed, the young birds seem much more susceptible than the old birds, with all birds becoming listless, unkept in appearance, developing cheesy material about the mouth and often showing diarrhea. A toxicity problem (toxicity from the seeds) rarely occurs other than with the feeding of screenings.

This group of plants, as indicated, are tolerant of 2,4-D as normally applied, but appear to be susceptible to some of the newer materials. These new herbicides are more phytotoxic than the 2,4-D's and don't have as wide a safety margin, insofar as selective control is concerned. Dicamba (Banvel-D) is registered for use on cereals for the control of this group of plants. The recommended rate is extremely low--in the neighborhood of 2 to 4 ounces to the acre, twice that amount will very

likely be detrimental to the grain. The species and varieties of grains show differences in tolerance or susceptibility, hence while we have a tool, we have some studying to do prior to its gross use.

DEATH CAMAS (Zigadenus species)

(Liliaceae Family)

The death camas representatives of our area fall into three types. They are the foothills death camas (Z. paniculatus), the meadow death camas (Z. venenosus), and the mountain death camas (Z. elegans). These plants may be known by a host of common names; e.g., poison sagos, poison camases, poison soap roots, lobelias, alkali grass, water lily, wild onion, mystery grass and hog potato.

The plants are erect, perennial, glabrous herbs growing from an onion-like bulb, (no onion odor). The leaves are grass-like, long, narrow, and distinctly keeled with distinct parallel veins. The lower leaves will have papery sheaths, characteristic of the family, but the upper leaves may be without distinct sheaths. The height of the plant will vary from a few inches to as much as 4 feet. The flower size and density vary with species, but flower color is normally within a range of greenish-yellow to white. Characteristic of this family, the floral parts are in three's and six's, with the three-parted seed pod, six stamens and six combined sepals and petals.

Death camas occurs over a wide area seeming to require but the combination of moisture and slowly-drained soils. It is common on overgrazed areas and is most common on grass lands that overlie calcium soils.

The poisonous principles are steroid alkaloids which seem to be distributed throughout the entire plant. The seed have the greatest concentration and bulb the second greatest. The bulb is rarely used, however, as it normally develops from 4 to 10 inches below the surface of the soil.

The plant is primarily poisonous to sheep, due to the fact that they eat it. A mature sheep normally requires one and one-half to five pounds of fresh material to die. The amount, of course, depends on the condition of the animal--whether or not it is hungry--and the length of time over which the feeding occurred. The same amount, proportional to weight, may be equally toxic to cattle, horses, and swine. There are a few reports of horses utilizing this plant and most studies indicate that cattle avoid it unless forced to utilize it in the absence of other feed. Poisoning of man has been reported from both bulb and flower.

Symptoms characteristic of death camas poisoning are rapid weak pulse, excessive salivation, nausea, weakness, convulsions, and finally coma, followed by death.

Fair controls have been obtained by treating with 2,4-D ester at 3 pounds per acre during the early bud stage of the plant. Water or oil may be

used as a carrier but if water is used a spreader-sticker in 10 gallons or more of solution per acre is recommended. Retreatments in subsequent years can be expected.

RED ELDERBERRY (Sambucus racemosa)

(Honeysuckle Family)

Shrubs or trees with opposite pinnate leaves and small white yellowish or pinkish flowers in compound cymes (flat top clusters). The fruit is bright red or rarely brown, containing three to five one-seeded nutlets.

The plant is relatively common on stream banks and mud flats, mostly near the coast. Several species of elder have had bad reputations for many generations yet cases of poisoning clearly caused by them have rarely been reported. However, cases of poisoning of cattle, hogs, and human beings have been suggested. The plant contains substances which are purgative if taken in moderate amounts. The roots, perhaps, are the most poisonous parts and may be responsible for the mortality reported in hogs. Under unusual circumstances the foliage or young growth may be consumed by cattle with harmful effects. Accidents involving children have occurred either from ingestion of the roots or from using the stems of this species for blowguns. The fresh berries are used for various purposes by some people and appear to be the least toxic part of the plant and harmless when cooked. Uncooked berries may nevertheless produce nausea.

WESTERN FALSE-HELLEBORE (Veratrum californicum)

(Liliaceae Family)

Western false-hellebore, sometimes known as corn lily, due to the arrangement of the leaves (similar to that on a stalk of corn) and as skunk cabbage, due to the resemblance of the young plant to the skunk cabbage of similar areas, is a showy perennial, varying in height from 1 to 6 feet. The leaves are alternate, 6 to 12 inches long, having a bright yellow-green case and the general shape of a boat with prominent ribs; there is a hairiness connected with the basal sheathing. The stems, as indicated above, somewhat resemble a corn stalk and may be somewhat white woolly on their upper portions. The rootstock is perennial, short, somewhat bulbous and very heavily fibrous-coated. The flowers are representative of the Liliaceae group, being six-parted in the perianth, (three petals and three sepals) with six stamens and a three-parted seed pod. The individual petals are egg-shaped, blunt-tipped, and tend to be veined with green. There often is a greenish Y-shaped spot at the base of the individual floral part. The flower color is a dull white. The individual flower may vary in size from 1/2 to 1-1/2 inches in diameter.

Western false-hellebore occurs exclusively on moist soils in the mountainous regions. It grows largest and most abundant on the moist and deep meadow soils, although it also does well on the shallow and coarse soils of moist or springy slopes and flats. Not infrequently, this herb invades and dominates eroded but moist flats and slopes and in serious cases of over-use may be one of the last perennial plants of the meadow association to disappear.

The poisonous principle is an alkaloid, which is concentrated in the root and young shoots of the plant. As the plant matures the poison decreases in the aerial portions, so that the species is practically harmless at maturity or by the time it is killed by frost. Reports indicate that all classes of livestock are poisoned, but it is generally agreed that the danger is slight when there is plenty of other forage and the animals have normal appetites. Poisoning that has been reported has usually been from abnormal conditions; e.g., stock on drives, on bed grounds, overgrazed ranges, or in gathering pastures where hungry animals graze anything readily within their reach. Monkey-faced lambs (Southern Idaho) can be caused by the ewe feeding on V. californicum during the second and third weeks of pregnancy. Tests also showed that similar feeding could in some cases be the direct cause of abortion.

The toxicity symptoms are indicated as: salivation, burning in the throat, weak pulse, and labored respiration. Poisoned animals usually recover in a few days, although in very serious cases they may die in a few hours.

2,4-D esters at rates of 3 to 4 pounds per acre applied in water at 50 g.p.a. or more between the full-leaf stage and the bloom stage have given 93 to 95 percent kills in one year. Complete removal would require retreatment of the area.

FIDDLENECK TARWEED (Amsinckia intermedia)

(Boraginaceae Family)

Fiddleneck tarweed, known as fiddleneck, tarweed, finger weed and fire weed, is an annual that reproduces by seeds on cultivated lands and extremely overgrazed ranges. The stems are erect and may have two or more branches. The height of the plant will vary from 1 to more than 2 feet. The entire plant is covered with stiff, white, bristly hairs. The leaves are linear to lance-linear and rather thick. The flowers are perfect, yellow, and are arranged on one side of a scorpioid inflorescence which resembles the neck of a fiddle. Probably as good a key as any to mature plants is the typical Borage arrangement of the seed. The seeds are as four individual nutlets, attached near the base and are seen as a square arrangement.

Fiddleneck is native to this part of the United States and is common in grain fields, gardens, orchards, and waste places within the semi-arid or transition zone. It is most common in the area from the sagebrush/bunchgrass area to the ponderosa pine zone.

The most common source of poisoning from fiddleneck is from the use of chaff or screenings from the wheat fields as a winter supplement. A feeding test including 25 percent nutlets (fiddleneck seed) mixed with wheat grain was used as a fattening ration for two lambs for 125 days-- it appeared to cause no harm to the lambs; however, a diet of 5 percent Amsinckia seeds killed a pig in 2 months.

The feeding (experimentally) of fiddleneck seed has, in severe cases, produced hepatic cirrhosis in swine, horses and cattle. Swine appeared to be the most susceptible. Inferences from data on other members of the Borage family (Echium and Heliotropium) suggest pyrrolizidine. Nitrate poisoning has been suspected in California.

2,4-D on the rosette stage in seasons of warm growing weather will do the job. Materials in test today offer more reliable controls.

FOXGLOVE (Digitalis purpurea)

(Snapdragon Family)

The common introduced foxglove has become relatively common in much of western Washington now used as pasture. It is particularly adapted to fence rows and sites adjacent to stumps. It normally is found in with the brush, briars, etc., of those areas. It is easily recognized by its stem of somewhat snapdragon-like tubular flowers which may be purple to white with conspicuous dark spots on the inside bottom surface of the floral tube.

When found as a naturalized species (adapted, escaped, introduced ornamental) it is likely to be in thin forage areas, on rich bottom land, or occasionally as an early successional species on logged-off areas.

Poisoning usually results from the consumption of the fresh plant or maybe from the consumption of the plant in hay. Poisoning is uncommon since the plant is not normally used by foraging animals. The poisonous properties include perhaps a dozen chemically and physiologically related cardiac and steroid glucosides. They exert a two-fold influence on the heart, strengthening its force of contraction and slowing its over-all movements.

Symptoms are variable in livestock, but are essentially the same as the doctor would expect in humans. Commonly noticed are signs of gastric distress including bloody stools, drowsiness, lack of appetite, frequent attempts at urination, abnormal urine and symptoms associated with the cardiac effects of glucosides. Posted animals show congestion throughout the venous circulation, greatly distended heart parts and varying amounts of intestinal inflammation. Contrary to that which is true of many poisonous principles the lethal properties of foxglove are not lost by drying or boiling and hay containing the plant has, in some cases, been lethal.

I know of no chemical herbicide trials with this plant. Similar plants, within this same family, are controlled by silvex applied at about 2 pounds per acre during the stemming-up stage of the plant. That, as indicated, is based on comparative results within the family and not from trials on this species.

GOATWEED (Hypericum perforatum)

(Hypericaceae Family)

Goatweed, known also as Klamath weed or St. Johnswort, is a very aggressive, moderately poisonous range weed introduced from Europe to the East Coast about 1800 and known to have been on the Pacific Coast since 1900. This plant is very individualistic and should be easy to identify in almost any stage of growth. The stems which are green when quite young slowly begin to take on additional red color and by fall, with the dropping of the leaves, will appear red and will stand out in other herbaceous vegetation. The flowers are yellow, five-parted with numerous stamens and may reach 1 inch in diameter. There will be one to several in a round-topped cyme. The central flower will bloom first. The leaves, which are opposite, oblong to linear and 1/2 to 1 inch long, are stalkless and glandular-dotted. These glandular dots, if the leaf is held between the viewer and a source of light, appear to be perforations in the leaf.

Goatweed, while aggressive insofar as the disturbed areas on a range are concerned, is seldom found outside direct sunlight. The factor of light appears to be the major requirement for its establishment. Fire, normal under range conditions, according to Sampson and Parker, extended the stands of goatweed in California. Both by regrowth of old plants from crowns and underground runners and through an increased germination of the heated seed.

The poisonous properties of goatweed are not well known. It is known to be photodynamic in that it causes a blistering of white skin (non-pigmented areas) on feeding animals. While the greatest attention seems to be to the photodynamic qualities of the plant, the entire plant must be toxic at least to cattle. Marsh and Clawson showed that cattle were more susceptible to this poison than were sheep. These investigators reported that consumption of green foliage equivalent to 4 percent of the animal's weight poisoned sheep, but as little as 1 percent was toxic to cattle with 5 percent of those fed proving fatal. Spense of Idaho, reported that 1 percent would sicken an animal and that 7 percent was required to kill said animal.

The symptoms characteristic of goatweed poisoning are uneasiness, blisters on white skin of ears, face, and sides and an increased pulse, increased temperature, increased respiration probably caused by intense skin irritation. Sick animals lose weight and in severe cases become blind, develop sore mouths, and may even die from malnutrition. The poisonous effects of goatweed are largely cumulative and result in lower market prices and curtailed wool quality and yield.

Two pounds of 2,4-D applied prior to flowering will do a good job on goatweed. If one would prefer to use a dry material, any of the borate compounds applied at 1 to 2 pounds per 100 square feet as a powder to a moist surface or when rain is expected is effective.

GREASEWOOD (Sarcobatus vermiculatus)

(Chenopodiaceae Family)

Greasewood is an erect shrub, 3 to 10 feet high, much-branched and in general rather round in appearance. It is very thorny (twig tips) with the breaking of the skin by the thorn creating a burning sensation. The bark of greasewood becomes grey and almost white on the older stems. The leaves are alternate, sessile, linear, fleshy and usually 1/2 to 1 inch long. They are bright green when young, becoming rusty-colored as they age. The fleshiness of the leaves is (along with the color of the bark and the presence of the spine) the basic field characteristic used in identification of this plant. The vermiculatus, which is the species' name, infers that the individual leaves are worm-like in appearance.

Greasewood is widespread, insofar as ecologic amplitude is concerned, but is most common on a dry alkaline or saline site. It normally occupies the zone of maximum alkalinity or salinity and may occur as a distinct stand surrounded by the less tolerant species; e.g., Atriplex, Artemisia, Eurotia, Kochia, and so forth. There are indications that this species does not hold this area too tenaciously and that if disturbed it may be replaced by another species, normally found in the area, and may not, within recorded history, re-establish itself.

The poisonous principle in greasewood is soluble oxalates. Sheep, hungry and on pure greasewood, seem to be the most common victims. While the greasewood is regarded as a valuable forage plant in the winter and early spring, thousands of sheep have been reported (Marsh et al, USDA Circ. 279, 1923) to have been killed by eating large quantities of greasewood in a short time. The young growth is considered very palatable, but should not become the exclusive diet. Cattle also have been reported as poisoned by this type feeding (Fleming). Oxalate concentration increases throughout the season in leaf material. Toxic amounts may be 1.5 to 5 percent of a hungry animal's weight.

The symptoms of greasewood poisoning are: depression, weakness, weak pulse, and in some cases, weak respiration--having all been described for sheep.

2,4-D esters at 1 to 2 pounds per acre applied to the rapidly growing plant has been reported to give 100 percent control.

GREY HORSEBRUSH (Tetradymia canescens)

(Compositae Family)

Grey horsebrush, known also as spineless horsebrush, is an unarmed, much-branched shrub, 8 to 24 inches tall. The leaves, twigs, etc., are covered with short white hair. The leaves are entire and do not have a sage odor. Among the plants that might confuse the average fieldman in this area would be Chrysothamnus (Rabbitbrush), Tetradymia (horsebrush), and Artemisia (sagebrush). These may be separated by two relatively simple techniques provided one has flowers with which to work. The Chrysothamnus and the Tetradymia will have papus which is a vestigial calyx. The Artemisia will have no papus. Between the Chrysothamnus and the Tetradymia the distinction is the phyllaries or bracts around the flower head. In the case of Chrysothamnus there will be seven or more. In the case of Tetradymia, while tetra infers four, there will be four and sometimes five or up to seven. The yellow flowers are normally four in each flowering head.

Grey horsebrush is normally found with big sagebrush (Artemisia tridentata). In this area that association covers much of the arid-transition zone in that part of Washington and Oregon which is east of the Cascades.

The major problem area, relative to toxicity, is the photodynamic reaction which the plant causes when fed on by sheep in the early spring. This causes a photosynthesizing and an irritation on non-pigmented skin tissue. Also the disease of sheep known as Big Head is considered to be caused by this plant. There are some authorities who claim that in order to produce Big Head in sheep it is necessary that the sheep be utilizing Tetradymia and A. tridentata at one and the same time. The plant is considered unpalatable, but sheep may graze upon the buds and leaves early in the spring. It has been reported that 2 pounds a day for two days (Sampson and Malmsten) is fatal to sheep.

The symptoms may vary under different conditions and in different regions: depression, weakness, sometimes death within a few hours. In many cases acute illness is followed by a sensitiveness and irritation about the head followed by swelling of the head, neck, ears, eyelids, and nose. This is especially common in sheep that have been exposed to sunlight.

The horsebrush species are listed as intermediate or resistant to the 2,4-D materials normally applied for the control of big sagebrush. I know of no specific work related to the control of this brush selectively although I suspect that it is closer to Chrysothamnus in response--so try 3 pounds per acre when bunchgrasses flower but before soil moisture is depleted.

KEY

- A Ray flowers present Gutierrezia
- AA Ray flowers absent
- B No papus Artemisia
- BB With papus
- C Phyllaries 4 to 7 Tetradymia
- CC Phyllaries more than 7 . Chrysothamnus

HORSETAIL RUSH (Equisetum arvense)

(Equisetaceae Family)

Horsetail is known by the following common names: scouring-rush, snake-grass, jointgrass, joint-rush, pinegrass, and meadow pine. The plant is one which creates considerable confusion due to the fact that it is not a seed-bearing plant, but is rather a sporophyte, having three distinct forms of growth. This plant is normally a light green, erect, perennial, growing from 6 inches to 3 feet tall and varying with season as either a fertile, unbranched plant with a cone-like growth at the top (which is brown) or a sterile, many-branched plant whose leaves appear in whorls. The third form of growth is a minute prothallus which is produced from the spore and which in turn produces the first stage prior to the normal spring appearance of the sterile stage.

Horsetail is common on moist soils whether it be gravelly, sandy, overflow land or merely low wet areas. It is particularly common around spring heads.

Horsetail is considered poisonous to horses and cattle. Young animals seem more susceptible than older animals. The several species of horsetail vary in toxicity to different species of animals. The poisonous principle is not generally agreed upon. For a long time it was believed that the harmful effect was due to the extremely high silica present in the plant. This belief was later discarded when aconitic acid was found in the plant. Later an alkaloidal nerve poison was shown to be present. It has also been suggested that some cases of horsetail poisoning are due to the fungus which may be found growing on the plants. Poisoning may occur when eaten by grazing animals, but it is generally believed that the laxative effect of the plant is such that when green there is a lack of accumulation of toxic properties; whereas, the use of heavily contaminated hay (no laxative effect) may cause the normal symptoms of poisoning (particularly in horses).

The symptoms are unthriftiness and loss of weight, followed by a loss of the control of muscles and swaying or staggering. Later the animal loses its power to stand and goes down, becoming very nervous and often struggling violently to get up. The pulse becomes slow until toward the end when it is rapid and weak. The temperature is below normal; the visible lining membranes of the mouth, nose, and eyes become pale.

Where applicable, Amitrole at 8 to 12 pounds (in water) per acre on rapid early summer growth has given very good control. MCPA at 1 to 2 pounds per acre will give seasonal control with measurable reduction in the horsetail stand. Casoron looks very promising where permissible.

IRIS (Iris species)

(The Iris or Flag Family)

The garden iris are familiar plants. The wild iris may be recognized when in flower but otherwise may be confused with large members of the sedge family or even the more common cattails.

The combination of long, erect, parallel-veined two-ranked leaves with thick, fleshy, mostly horizontal rootstocks serves to separate iris from similar plants of wet habitats. The wild iris are found chiefly on moist soils; e.g., along streambanks, in marshes, and occasionally in mountain meadows.

Several of the iris contain an irritant in the leaves and particularly in the rootstocks which produce gastro-enteritis if consumed in large amounts. Calves have been reported poisoned in British Columbia from consuming cultivated species. Experimental poisoning of laboratory animals was produced (Wyoming, Agr. Exp. Sta. Bul. 324, 1953) using the common wild iris (Iris missouriensis) of the intermountain area.

Iris may be poisonous fresh or in hay. Several species of iris have been reported as toxic in other parts of the world.

Iris is susceptible to 2,4-D. The rate and technique is similar to that used on tussocks or tules--4 pounds per acre in large volumes of water (plus a wetting agent) prior to flowering; if spot treating, use 4 pounds per 100 gallons of water (plus a wetting agent) and spray to wet.

JIMSON-WEED (Datura stramonium)

(Solanaceae Family)

Jimson-weed is known to ranchers as Jamestown weed or thorn-apple and to flower gardeners as trumpet flower or moon flower. It is primarily through its ornamental uses that it has been introduced into this area.

Jimson-weed is an annual herb, with erect stout stems, 1/2 to 3/4 inch in diameter, 18 inches to 3 feet tall, which are dicotomously branched. The branches are smooth and may vary in color from green to shades of purple. The leaves are alternate, simple, egg-shaped in general outline, but with extremely uneven toothed edges. The plant is strong-scented. The flowers, in the axils of the branches, are trumpet-shaped. They vary from white through blue or purple, from 2-1/2 to 6 inches long and from 1 to 3 inches wide. The border is toothed. The petals are joined and as each petal produces one tooth, there are five teeth around the fringe of the trumpet-shaped flower. The seeds are produced in a hard, egg-shaped, four-celled capsule which is covered by short, hard prickles.

As indicated above, this plant has been introduced widely and is beginning to show up as a weed, particularly in central Washington. It shows up in cultivated fields and on waste places, mostly on the more fertile soils where there is available waste water to supplement that which would normally occur in the central Washington area.

Cattle (10 to 14 ounces is lethal--Fla. Agr. Exp. Sta. Bulletin 510,1952), horses, and sheep have been poisoned by feeding on the tops of this plant, and children have been poisoned by eating the seed pods. Contact with the leaves and flowers may produce a dermatitis on some individuals. The poisons include several alkaloids: atropine, hyoscyamine, and hyoscyne (scopolamine).

The symptoms of poisoning are as follows: headache, nausea, vertigo, extreme thirst, dry burning sensation in the skin, dilated pupils, loss of sight and involuntary motion, and in extreme cases, mania, convulsions, and death.

As a member of the Solanaceae family, it will show tolerance to 2,4-D, however, the newer more phytotoxic herbicides; e.g., 2,4,5-TP and so forth, are effective.

LOW LARKSPUR (Delphinium species)

(Ranunculaceae Family)

Low larkspur is a perennial herb normally less than 12 inches tall and rarely reaching 2 feet. It is sparingly leafed but may be branched at the base. The leaves are alternate, somewhat rounded or kidney-shaped in outline, palmately 3 to 5-parted with each of these divisions variously cleft or lobed. The root of the most common species found in the sagebrush country (menziesii) is a cluster of perennial tuberous-like roots. The flowers are showy, dark blue to purplish, with five irregular petal-like structures, 1/2 to 3/4 inch long. The true petals are pale with conspicuous purplish veins and enclosed in the spurred sepal. Stamens are numerous.

These species grow in numerous associations, varying from aspen through the openings in the lodgepole pine zone into the sagebrush-oakbrush and ponderosa pine zones. It is especially characteristic of the open grass/weed/brush areas. It frequently associates with the lupines, bluegrasses, wheatgrasses and rabbitbrushes. It inhabits a variety of soils, dry to moist, shallow to sandy, gravelly or rocky to deep loams and heavy clays.

Low larkspurs cause heavy losses of cattle in the spring and early summer ranges. It is widely distributed and occurs in dense populations on a variety of soils and is readily grazed. No known losses of sheep or horses have occurred from the spring use of low larkspurs. The best control measure is avoidance by late use of areas known to be heavy to low larkspur. The plant seeds dry up and disappear by early summer.

The toxic principle is a group of alkaloids. The symptoms which normally occur are loss of appetite, general uneasiness, and a staggering gait. In acute cases, the animal falls and lies with its feet extended more or less rigidly. Poisoned animals are constipated and severe cases are nauseated and some are also bloated.

The low larkspurs can be controlled by 2,4-D ester at 2 pounds per acre, applied when larkspur has fully emerged. Reported kills have been 87 and 93 percent at 1 and 2 pounds per acre respectively. It was observed that plants which were in flower at the time the spray was applied were not killed. Best results are from sprays applied before the larkspur's flowering stems are 2 inches high.

TALL LARKSPUR (Delphinium species)

(Ranunculaceae Family)

Tall larkspur is a perennial herb of the higher elevations in our foothills and mountains. The flowers vary with species, from pink or cream-colored through shades of blue to purple. They are irregular in form and arrangement. A more common form of tall larkspur in the West is known as the dunce cap larkspur (D. occidentale), in which the characteristic spur is tipped in such a manner as to suggest a dunce cap. The leaves are alternate and generally rounded in outline. They are mostly 6 to 7 divided with the divisions being lance-shaped or diamond-shaped relative to the outer edge. The stems are hollow, leafy, erect and may reach 6 feet tall. They are normally hairless below but may be covered with fine closely pressed hair on the upper portions. The root is a stout woody perennial. The tall larkspurs are typically plants of the higher elevations.

They occur on a variety of soils but prefer the richer loams in the more moist situations. The plants occur on both open and shaded sites and are common in the aspen belt.

While experiments have not definitely shown all larkspurs to be poisonous, the wisest range management must assume that all species of larkspur when abundant are dangerous. The tall larkspurs responding to their environment do not behave as do the low larkspurs and consequently flower in mid-summer and mature with autumn.

It has been stated that with the exception of the loco weeds the larkspurs cause greater loss among cattle than any other group of poisonous plants. Most cases, as reported under low larkspur, occur early in the season when the low larkspur is utilized as green forage in a period of low grass productivity, but in the area where snows remain late poisoning occurs late in the summer or even in autumn from the tall larkspurs.

The earlier investigations indicated that sheep and horses were not injured by grazing on larkspurs but more recent investigations have shown that sheep may be poisoned when they are fed large quantities of young fresh plants of Delphinium Barbeyi. Cattle are poisoned by 7/10 percent of the body weight. Toxicity reported decreases with maturity--being perhaps 50 percent of potential at flowering time--even less later.

The symptoms occurring from the alkaloidal poisons present in larkspur are: loss of appetite, general uneasiness, and staggering gait. In acute cases the animal falls and lies with feet extended more or less rigidly. Poisoned animals are constipated and severe cases are nauseated and some are also bloated.

Tall larkspur control has recently been reported from Idaho by spraying to wet with a solution of 4 pounds of silvex in 50 gallons of water. Spray after all shoots have emerged but before flowering. Spraying in this case may make the plant more palatable and hence a menace. You might consider staying out of the area for a couple of weeks. Late summer or fall treatment (post-grazing) with the sterilants will do the job without interfering with grazing, however, cost will go up for both chemical and labor.

More recent developments suggest that the granular forms of soil-applied systemic herbicides; e.g., Tordon beads, may be a practical answer to location and treatment problems. NOTE: This material has no clearance (1-68) on forages (range or pasture).

LOCO WEED (Astragalus or Oxytropis species)

(Leguminosae Family)

Members of this group may be known as loco weeds and designated by their colors, as white loco, blue loco, purple loco, or by their appearance, woolly loco, or they may be classified as vetch forms, as poison vetch, green vetch, timber vetch, milk vetch, and so forth. These are perennial herbs of great practical and scientific interest--they may be poisonous plants in some areas and responsible for heavy losses of cattle, sheep and horses or grazed in other areas without injurious results. The plants vary in general aspect, but all have leaves which are divided, odd-pinnately, into 7 to 17 leaflets. Usually all but the one at the end are in pairs. The leaflets in the case of the vetch group are flat, rather thin, linear, quite hairy, with the lower leaflets larger than the upper. In the case of the loco group the leaflets are flat, egg-shaped to oblong, densely covered with yellow silky hairs and again the lower leaflets are larger than the upper. The plants are much-branched, with slender stems spreading from the base. The roots are tap roots, perennial and slender, but may show considerable thickening in the crown area. The flowers are variable in color but retain the characteristic pea form.

As indicated above, there is a great lack of information and consequently much confusion relative to the species of these genera. For example, the timber poison vetch (A. convallarius), known in eastern British Columbia, eastern Washington, Montana and south, unlike many poisonous plants, is palatable to all classes of livestock. Losses, as identification, have been erratic. On many ranges, sheep and cattle may eat timber poison vetch in relatively large amounts without being injured, while there have been cases reported of deaths among horses as high as 10 to 40 percent. It has also been reported that among sheep and cattle females suckling their young are by far the more susceptible. The greatest losses among animals are newcomers to the range. It seems that in time they develop partial, but never complete, immunity to the poison. Greatest losses occur during dry seasons and the majority of range losses to the members of this genus are intimately connected to a shortage of other forage. Even bees have been reported poisoned--spotted loco in Nevada (Sci. 79 (2041):5, 1934).

There are extensive local languages connected to the symptoms caused by the alkaloidal poisons in this group. Such terms as alkali disease, blind staggers, cracker-heel, knocking disease, mountain fever, roaring disease, timber paralysis and timber trouble are used descriptively.

The greatest danger from poisoning seems to be after the plant has blossomed. The period of greatest danger is when the pods have formed. The pods and the seeds seem to have the greatest concentration of the alkaloidal principle.

The symptoms vary as do other reports relative to this group of plants. The disease has been reported in some instances as chronic, lasting from several months to several years, and in other instances, as acute and fatal within a few days. Chronic symptoms include sluggishness and inactivity, weakness, defective nutrition, depraved appetite, impaired vision, tendency to wander, and varying degrees of paralysis, especially in the hind legs. In acute cases one or more characteristic symptoms are noticeable: sudden attacks in which the heart beats very rapidly and spasmodically, blind staggers, muscular incoordination which causes the animal to knock its heels together, or paralysis beginning in the hind legs with a tendency to spread to other parts, difficult breathing often accompanied by wheezing or roaring (roaring disease). In fatal cases death ordinarily results from respiratory paralysis or from heart failure and may occur within a few days after the first symptoms occur.

Apparently under favorable conditions loco weeds can be controlled with the ester formulations of 2,4-D. The best kills are obtained if sprays are applied at the time the plants are in bloom and there is abundant soil moisture. Two pounds per acre of an ester of 2,4-D in a water or oil carrier is recommended. It has been reported that the white loco is the most difficult of the group to kill with the above recommended application.

BLACK LOCUST (Robinia pseudo-acacia)

(Leguminosae Family)

Black locust is a cultivated species in the West, or at least one which was originally established through cultivation as a drought-tolerant shade tree. It is a small tree, relatively speaking, with thorns or spines on the twigs or branches and leaves that are alternate and pinnately compound. The individual leaflets tend to be round to egg-shaped. The flowers are the typical pea-type and are produced in very attractive drooping racemes.

The distribution of this plant now, insofar as any large concentrations are concerned, is restricted primarily to the areas of homesteads and their drainages.

Horses, mules, cattle and sheep have been fatally poisoned by eating the bark and young shoots of black locust. Children have been made ill from chewing the inner bark of this tree.

The poisonous principle is a phytotoxin called robin. In Alabama a horse showed symptoms one hour after taking an aqueous extract of bark equally about 1/10 of 1 percent of body weight. In Japan a 4/100 percent of body weight application of powdered bark was sufficient to poison a horse. Horses may be 10 times as susceptible as cattle.

Symptoms noted are anorexia, lassitude, weakness, posterior paralysis in cattle and horses, dilation of the pupils, and so forth. Fatal cases are rare. Recovery is slow.

LUPINE (Lupinus sericeus and other species)

(Leguminosae Family)

The lupines, which compose one of the largest, most widespread and characteristic genera of western plants, are familiar to most persons interested in the vegetation of their region. They are erect, often much branched, herbaceous plants, varying from glabrous to densely woolly in appearance. The leaves are palmately lobed and have five or more leaflets. The flowers are in terminal racemes, vary in color from white through yellow into the blues and violets and retain the characteristic pea form. The fruit is a pod, straight, compressed on its sides and has two distinct sutures. The plant is much-branched from the crown. The root is perennial, woody and tends to be thickened at the top, forming a crown.

The lupines of this area grow chiefly on the well-drained soils from the fringes of the sagebrush zone to the well-forested coniferous zone.

Not all lupines are poisonous, but it is difficult unless you happen to be a lupine specialist to distinguish one from the other. The poisonous principle is an alkaloid. The seeds are reported to be the most toxic part of the plant. Most cases of poisoning result from eating pods with seed. (Fully developed pods with seeds were reported toxic at 1-1/2 percent of body weight for sheep.)

Most losses from lupine occur from sheep in late summer or autumn. This danger is intensified by the normal shortage of feed at that time of the year. Sometimes an early snowfall may cover much of the shorter vegetation and leave the lupine stems with pods projecting above the snow-- again intensifying the danger of animal loss.

The symptoms produced are nervousness, difficult breathing, frothing at the mouth, convulsions, coma and death.

Lupine can be controlled or eradicated by 2,4-D at 2 pounds per acre applied after the plants reach 5 inches tall but before the bloom stage. The foregoing treatment has given as high as an 80 percent kill the first year. Follow-up treatments on successive years should eradicate the stand.

MILKWEED (Asclepis species)

(Asclepiadaceae Family)

The milkweeds range in appearance and form from the whorled milkweeds which have narrow leaves appearing in whorls of 2 to 6 around the stem, to the broadleaved milkweeds which have opposite leaves 2 to 4 inches wide. These plants are erect, glabrous perennials from 12 to 36 inches high, produced from horizontal creeping rootstocks. The flowers appear in terminal or lateral umbels with 5 greenish-white sepals and 5 united

petals forming a series of hoods. The fruit is a hairy, narrow, follicle 1 to 4 inches long, which bursts when ripe to produce numerous seed with tufts of silky hair.

The milkweeds often develop into small colonies on dry sites. The plants require an open sunny site and once established the deep set and extensive root system enables the species to withstand extensive drought. It does occur, however, on more moist sites and spreads much faster under these more favorable conditions.

The plants are not utilized intentionally by livestock. The maximum losses have been with sheep on trails, bedding grounds, overgrazed pastures or fields where the animals were forced to eat this plant. Investigations indicate that ordinarily 1-1/2 to 2-1/2 pounds of the Mexican whorled milkweed is sufficient to kill a 100-pound sheep. It has also been stated that 5 pounds or more may be expected to kill yearling calves. It is safe to conclude that the plants are poisonous to horses.

The poisonous principle is a group of resinoids and the symptoms are listed as: depression, loss of appetite, diarrhea, lower temperature and a rapid pulse rate.

It is interesting to note the number of times in the literature that one encounters the statement that the plants are so distasteful that they are not intentionally eaten.

It appears from observations that the milkweeds may be killed by either amitrole (ATA) or the benzoic formulations at sterilant rates. Recent developments in temporary sterilants, though untried to date, should be equally as effective.

MUSTARDS (Cruciferae Family)

The mustards, by and large, are annuals or winter annual weeds which have been introduced into the grain fields of this part of the United States. The identifying characteristics most commonly used in the field are the mustard or cole crop appearance, the flavor of the leaves (normally spatulate and petioled) and the four-parted flower from whence the name comes--Cruciferae being from the word "cross". This is one of the few plants having four-parted flowers rather than multiples of five, three, and so forth.

SPECIES

Wild mustard	(<u>Brassica kaber</u>)
Small-seeded false flax	(<u>Camelina microcarpa</u>)
Hairsear mustard	(<u>Conringia orientalis</u>)
Wild radish	(<u>Raphanus raphanistrum</u>)
Field peppergrass	(<u>Lepidium campestre</u>)
Wormseed mustard	(<u>Erysimum cherianthoides</u>)
Tumble mustard	(<u>Symbrium altissimum</u>)
Fanweed	(<u>Thlaspir arvense</u>)

The mustards are common with numerous genera and species. They can be expected in any grain culture in this part of the United States.

The members of this family are not ordinarily considered as poisonous plants and probably the majority, if not all, are harmless in the young stages and are frequently grazed by all classes of livestock without harm. Those listed do, however, produce one or more mustard oil glucosides which, under certain conditions, are acted upon by enzymes and liberate mustard oil of similar substances. Feeds made from grain screenings containing large amounts of seed of any of these mustards may cause considerable trouble when fed to horses, cattle, and pigs. Feeds containing ground mustard seed should not be moistened with cold water before feeding or the enzymes liberate mustard oils before the feed enters the stomach. Boiling water poured over the feed tends to inactivate the enzymes responsible for liberation of the mustard oils. The mustard oils are very strong irritants.

The symptoms are as follows: chronic enteritis, haemorrhagic diarrhea, colic, abortion, nephritis, with haematuria, apathy, paralysis of the heart and of respiration.

Tansy mustard (Descurania pinnata), while the poisonous principle remains unknown, reportedly causes blindness and "paralyzed tongue" in cattle forced to use this annual as a source of green feed. Treatment is simple: administer 2 to 3 gallons of water and a nutrient (cotton seed meal) twice daily by stomach tube.

NIGHTSHADES (Solanum species)

(Solanaceae Family)

The poisonous nightshades most commonly encountered in this area will be treated separately.

Black Nightshade (Solanum nigrum) is an annual, much-branched herb with spreading, angular, smooth or hairy stems, 8 to 40 inches tall. The leaves are alternate with wavy-toothed edges; the flowers are small, typical of the five-parted wheel-appearing arrangement and are white. The fruit is a purple or black berry. The general form of the plant is similar to that of a garden variety ground cherry or husk tomato.

The habitat and distribution of black nightshade is wide throughout our fields and waste places. It is particularly common on cultivated areas with fairly fertile soil and sufficient moisture. This is primarily a weed of the cultivated and irrigated areas.

The poisonous principle is a glucoside (solanine). The leaves and the berries--particularly the unripe berries--are poisonous to the several classes of livestock. The green weed may be eaten in preference to stubble.

The most common symptom is a nervous condition which produces narcosis and paralysis. There also is a gastric form of poisoning which produces salivation, vomiting, bloating and diarrhea.

Blue nightshade (Solanum dulcamara) is known as European bittersweet, woody nightshade or red berry nightshade. The name--Blue Nightshade--comes from the color of the flowers, while the most striking characteristic is the extremely waxy red fruit. This nightshade has been introduced from Europe as an ornamental. It is a woody perennial with slender stems reclining or climbing over the fences, etc., of farmsteads or brush in adjacent drainages. The basic characteristic of this plant, in addition to the wheel-type blue corolla and the fused yellow center (the stamen) is the leaf which has a characteristic halbred shape. The leaf is composed normally of three lobes with two small lobes being opposite at the base of the leaf and the main or terminal portion of the leaf being ovate or obovate and about 1 inch in diameter. The fruit, as indicated, is round, pulpy and bright red with a thin, transparent, waxy-appearing skin.

This perennial nightshade is often found on rich moist soils of fence rows, waste places in farm yards, thickets adjacent to homes and on the banks of streams and ditches to which it has migrated from farmsteads.

Cattle, horses and sheep have occasionally been poisoned from eating the leaves and new shoots of this plant (Plant Poisoning. Vet. Rec. 38:795. 1925). The berries have proven themselves attractive to children and deaths have been reported in this state within recent years.

The poisonous principle is an alkaloidal glucoside (solanine) which is present in both the herbage and the berries.

The nightshades are not difficult to control. Those in row crop areas are normally controlled by the weed control measures that fit into the management of the crop. Those outside cropping areas, for example, the red berry or woody forms, are readily controlled with the 2,4,5-T materials. This group of plants seems to be more susceptible to the 2,4,5-T's than to the 2,4-D's.

OAKS (Quercus species)

(Fagaceae Family)

These oaks, commonly known as scrub oak or oakbrush, are erect perennial woody plants, varying in size and growth habit from a scrubby form to that of a small tree. The leaf is a typical oak leaf and the fruit is a small acorn.

The plant is normally found above the sagebrush zone on the drier sites, and occasionally in moist swales in scattered sections of the state.

When stock are turned early onto a range in poor condition or before other forage is adequate, oak leaves may constitute their only feed. When the stock are not turned on the range in good shape, where other feed is available, the oak may be considered a good browse plant. Experimental feeding has shown that a diet of up to 50 percent oak may be acceptable. Where the browse is oak, alfalfa as a supplement will reduce toxicity.

The poisonous principle is believed to be the tannic acid which is characteristic of the oak and the symptoms are listed as: constipation, feces containing mucous and blood, emaciation and sub-normal temperatures. There may also be surface swellings on parts of the body.

2,4,5-T or silvex (2,4,5-TP) at 1 to 2 pounds per acre are both effective as aerial treatments. Treatments seem most effective on active full-sized leaves. Reports from other areas indicate a preference for an oil/water combination (1:3) as a carrier. Retreatment one to two years later may be desirable.

Individual trees may be killed by:

1. 2,4,5-T at 12 to 16 pounds per 100 gallons of oil sprayed onto the trunk--ground level to 12 to 18 inch height--wet to run-off (winter treatment).
2. 2,4,5-T, silvex or ammate may be applied to frills cut in the trunk (2,4,5-T and silvex at rate described in "1", ammate at about 3 pounds per 1 gallon of water solution).

Several new herbicides or herbicidal combinations now in test look like real improvements in oak eradication; e.g., the picloram/2,4-D or picloram/2,4,5-T combinations.

POISON HEMLOCK (Conium maculatum)

(Umbelliferae Family)

Poison hemlock is a large biennial, sometimes perennial, herb, three to six feet high. Its smooth stems are purple-spotted and hollow. The spottedness is a key to this species designation. The leaves are parsley-like, being all pinnately dissected. This is opposed to the water hemlock, whose leaves are more nearly entire in outline though having toothed or wavy edges. The flowers appear in the characteristic umbels in the middle or late summer and characteristically are subtended by distinct dropping bracts. The root is the characteristic taproot of the carrot family and is said to be essentially free of poison in the spring or that season at which the foliage is said to be the most poisonous.

Poison hemlock grows as an adventive plant, dominating disturbed sites where there is sufficient moisture, seemingly independent of many other factors. It grows from the waste areas above the beach on the coast to

the roadsides of northeastern and eastern Washington. It is seldom a danger to livestock except as it becomes established in lanes, along roadsides, or around building sites--again, on extremely disturbed areas.

The poisonous principle is an alkaloid (coniine) which seems most apparent during the early development stages of the plant, up to and including flowering time. (Little in the roots and increasing in stem and leaves with maximum concentration in the seeds.) Very little of the plant would be utilized by any form of livestock if there were other sources of feed available. (The primary toxin is volatile and slowly lost during drying of the plant.) The plant reportedly has an extremely nauseating taste and when bruised, emits a disagreeable parsnip-like odor. The amount of alkaloid in the plant varies widely with conditions. Toxic amounts as reported vary from 1/4 to 1 percent to 4 percent of body weight for cattle.

The symptoms in man are a general and gradual weakening of muscular power with a loss of the power of sight and gradual paralysis of the lungs. The most prominent symptoms described for cattle are: loss of appetite, salivation, bloating, much bodily pain, loss of muscular power and a rapid, feeble pulse.

The hemlocks are relatively easily killed by 2,4-D at 2 pounds per 100 gallons of water per acre applied during the period of active early summer growth, before the flowering stage. A good precautionary measure would be the removal of stock at, and for a couple of weeks after, spraying. We don't really know which plants may become palatable to livestock due to spraying.

SMARTWEEDS AND DOCKS (Polygonum and Rumex species)

(Buckwheat Family)

This group of plants includes both annuals and perennials; plants that normally grow on the more moist sites. The perennials occur on the wetter sites of pastures, meadows, ditchbanks, and so forth. Characteristic of the plant is that the flowers are not separated into sepals and petals as are those of higher families of plants. The seeds are shiny and triangular in gross morphology. The leaves sheath the stem much in the same manner as do grasses. The name, Polygonum, which is the source of the family name, literally translates "many knees". This is from the angle common at the node to which each leaf is attached combined with the characteristic swelling at this node; hence, the stem normally appears to be a series of "leg" sections with each node representing a knee.

The habitats vary somewhat with the species. Generally speaking, however, they are found on fertile soils, high in moisture, with excessive moisture not being detrimental to the development of the plant. Periodic flooding doesn't hamper the development of these plants.

The Buckwheats which are either a crop of minor importance or a weed in much of the crop grown in the cooler more moist sections of the northwest are believed to produce photosensitivity somewhat in the same manner as does goatweed or St. Johnswort. The blisters develop on the unpigmented skin (white) of animals subjected to direct sunlight following feeding on these plants. Some of the Polygonum or smartweed species which are closely related to the Buckwheats are believed to create the same condition.

Rhubarb, another member of this family, due to its content of oxalic acid and soluble oxalates, may on some occasions be lethal to either livestock or to people. Reports of death from its consumption, either raw or cooked, have been substantiated.

The dock species (Rumex) are among the most common members of this family, particularly in forage-producing areas. The poisonous principle is the soluble oxalate. Most of the cases of poisoning which have been substantiated have been in other parts of the world, New Zealand, Australia, but from species considered the same as ours; sheep sorrel, curly dock, and sour dock. The reason for this may be that they have investigated plant toxicity more thoroughly than we, plus the fact that their management systems, by and large, are more intensive.

The docks, smartweeds, etc., are relatively easy to kill. The problem in their eradication is the lack of selectivity of the materials used relative to the desirable legume components of the forage mixture.

TANSY RAGWORT (Senecio jacobaea)

(Compositae or Sunflower Family)

There are more than 1200 species of groundsels (Senecio species), about 25 of this 1200 have been proven poisonous to livestock or to human beings. It is suggested that that number will grow as additional information is made available. Similar toxic alkaloids have been isolated from a number of additional species. The primary candidate in western Washington is tansy ragwort. This plant varies all the way from a winter annual through the biennial form to occasionally, if clipped, a short-lived perennial. It is from 1 to 4 feet tall with uniform leafiness all the way up the stem. The leaves are deeply lobed and the lobes are 1 to 2 times lobed or pinnately divided. The flower heads are numerous in flat top clusters. The ray flowers which appear to most people as petals are yellow and about 1/2 inch long.

Tansy ragwort seems to be pre-adapted to the second or perennial stage weed that follows the first or annual stage (fireweed) on land clear cut from Douglas-fir. It needs light, hence does not remain in the timbered areas. But, by the same token, it remains on this type of site if the site is managed to retain a herbaceous (forage-producing) plant community.

Several livestock diseases characterized by lesions on the liver are related to the Senecios. Stomach staggers, as reported early in the British Isles, was believed caused by tansy ragwort. Pictou disease of cattle in Nova Scotia early in the 19th century caused serious losses of cattle and it, too, was associated with tansy ragwort. Other diseases reported to be related to the forage utilization of tansy ragwort are the Winton disease of horses and cattle in New Zealand; the Molteno disease of cattle in South Africa; and Sirasyke in Norway. Much work has been devoted to attempting an understanding of this condition. Work in New Zealand, Canada, Nova Scotia, and other countries is believed to have confirmed the suspicions.

In summary, it is believed that doses of 1 to 5 percent of an animal's weight fed at one time over a few days will bring on acute poisoning. An example is a record of a cow killed in 18 hours by consuming 3.2 percent of its weight as this plant. Acute poisoning, while not unknown under natural conditions, is rare.

Most natural cases in North America are of the type in which a relatively small amount of the plant is consumed daily over an extended period of time. Under these circumstances the effect of the plant is not only cumulative but progressive and the complex degenerative and regenerative changes that take place in the liver may not result in the appearance of symptoms until several months after the animal no longer has access to the plant. In chronic poisoning of horses the symptoms may appear abruptly. The affected animals stand apart, appear depressed, sluggish, and without appetite. The disease may run its course and kill the animal within a week or the animal may linger for a longer period. Yellow or muddy discoloration of the visible mucous membranes is observed and a peculiar sweetish or unpleasant odor comes from the skin of the animal. (In cattle chronic poisoning may produce a similar odor in the milk.) Weakness, uneasiness, signs of abdominal pain, emaciation and reduced sensibility occur. In some cases a depraved appetite is evidenced. Diarrhea and darkly stained urine may or may not be present.

The poisoning appears to be almost entirely the result of specific liver injury produced by the Senecio alkaloids. The exact appearance of the liver depends largely upon the duration of the disease. In acute poisoning there may be severe hemorrhage. All degrees of liver damage may be observed, dependent upon the stage of the case, the chronic or acute nature of the case, and so forth.

Senecio alkaloids are not destroyed by drying or during silage fermentation. In some European countries the hay is a frequent source of poison. Cases of silage poisoning are fewer but are apt to be more spectacular.

The control of tansy ragwort is really rather simple provided the program can be put together and carried to completion in accordance with known requirements for success. 2,4-D will do the job at 1 to 2 pounds per acre applied, in water with or without a wetting agent, when the tansy ragwort plants are in the early spring or seedling rosette stage. An

application of 2 pounds in the spring will eliminate tansy ragwort for that season. An application of 1 pound in the spring followed by 1 pound in the fall will do the job. Either application will be detrimental to the clover species in the forage mix but the annual white clovers of western Washington will readily reseed. The butyric formulations of 2,4-D and the MCP formulations, while less toxic to the clover species, are not equally effective on tansy ragwort.

Another plant known as tansy, the true tansy, (Tanacetum vulgare) is often found on ditchbanks, roadsides, and so forth, as an escaped herb. It was brought to this country for herb gardens and is now naturalized throughout much of the West. Loss of life, both man and livestock, has been recorded after symptoms of severe gastritis and convulsions. In most instances this has followed an unwise use of the medicinal extract of the plant. Abortion in cattle has been reported from the consumption of tansy in Pennsylvania. This is rare as the plant is not attractive to animals. Tansy can normally be distinguished from tansy ragwort by the odor of the plant, by the fact that it is a perennial from creeping rootstocks and the fact that it very rarely has marginal ray flowers which in the case of tansy ragwort give the latter the appearance of having petals.

WATER HEMLOCK (Cicuta occidentalis)

(Umbelliferae Family)

Water hemlock, known as poison hemlock and as poison parsnip, is a tall plant, sometimes exceeding 6 feet, which has a very definite ridged, hollow stem. The leaf is a characteristic often used as diagnostic in field studies. While several genera of the Umbelliferae have leaves which are bipinnately compound, none other than the Cicuta have leaves whose venation appears to run from the mid-rib to the notch in the leaflet margin rather than from the mid-rib to the middle (apex) of the margin tooth, as is characteristic of most venation. (It is reported in the Range Plant Handbook that the California water hemlock is the one exception within this Cicuta group to this distinct variation in leaf venation.) The characteristic most often used for water hemlock identification is the root structure. The rootstock is a short, stout, vertical, fleshy-type root, with numerous horizontal chambers inside (when cut parallel to the long axis there appears a ladder-like configuration). When cutting through the main rootstock, one should notice drops of yellow aromatic oil appearing on the cut tissue. This yellow aromatic oil is characteristic of the species. There is usually a cluster of smaller tuberous prolongations attached to this main root section. The shallow fibrous roots are rather few as compared to most root systems.

Western water hemlock is a moisture-loving plant and commonly grows in marshes, swamps, wet meadows, along streams, irrigation ditches and similar places. It occurs from the valley floors to elevations of several thousand feet. Ordinarily the plants have a scattered distribution although in certain restricted areas they may be found growing in dense stands. Some

of the irrigation systems in this state, which are 25 years old or older, have solid stands of water hemlock in certain areas.

This plant has not only killed large numbers of livestock, especially cattle and sheep, but has also resulted in fatalities to human beings. The root, crown, and other underground portions of the plant are the most poisonous parts. A small piece of root, which may easily be pulled by a grazing animal (especially in the spring) is sufficient to cause sudden and violent death. The older root parts are the most toxic (root toxicity is not lost by drying); the stems and leaves of the young shoots may poison livestock in the spring but are not so dangerous in the summer and autumn. The dried seeds and older tops probably are not a source of danger. The high percentage of fatalities in western water hemlock poisoning cases indicates the need for efficient prevention. Prevention at one time included herding, fencing, grubbing, and so forth.

The poisonous principle in water hemlock is a group of resinoids which causes the following symptoms in man: pain in the stomach, nausea sometimes leading to violent vomiting, diarrhea, dilated pupils, labored breathing and sometimes frothing at the mouth, with a weak and rapid pulse and violent convulsions. In other animals the symptoms are like those in man but less pronounced. The first symptom is generally frothing at the mouth, followed by uneasiness and pain. This is succeeded by violent intermittent convulsions in which the animal kicks, sometimes extending the legs rigidly, throwing back the head and bellowing and groaning as though in great pain. Peculiar spasmodic contractions of the diaphragm takes the place of vomiting in man. In fatal cases the convulsions grow more violent until terminated by death, which results from respiratory failure.

As indicated above, these plants are relatively susceptible to the 2,4-D type materials and if sprayed during the rapid growth period of early summer with a solution of 2 pounds of 2,4-D in 100 gallons of water plus a spreader-sticker or an emulsifier, the stand will be reduced and with repeated sprays can readily be eradicated. As a precaution, livestock should be removed from the area for a 2-week (estimate) period following spraying.

YEW (Taxus species)

(Evergreen Family)

The Yews are evergreen trees or shrubs. The barks are reddish-brown, thin, and tend to flake in scales. The leaves are linear, 1/2 to 1 inch long and two-ranked (opposite one another on the sides of the twigs). The upper surfaces of the leaves are dark green; the lower surfaces are greenish-yellow. The mid-ribs are prominent. The fruit is a single, stoney-seeded, berry-type surrounded by a scarlet cup, perhaps 1/2 inch long.

The Western yew (Taxus brevifolia) is a tree. It is normally found in the deep coniferous woods in moist situations. It is widely distributed but seldom found growing in pure stands. It is particularly common on the western slopes (forests which border the Pacific Ocean). An analysis of Western yew made specifically to detect poisons of the alkaloidal or glucosidal types (Jones, I. and E. V. Lynn, Differences in Species of Taxus. Journal of American Pharmacological Association, 22:528. 1933) failed to reveal those types of compounds.

The foliage, bark, and seeds of English yew are toxic to man and all classes of livestock, whether green or dry. The symptoms, lesions, and toxicity are best known for that species (Taxus baccata). The green foliage is reportedly toxic to horses and other single-stomach animals at about 1/10 of 1 percent of the body weight. For ruminants the amount required is about 1/2 of 1 percent of the body weight. The symptoms vary depending on the severity of the poison. It is usual for a large dose to be consumed. This results in sudden death without additional symptoms. Animals are found close to the offending plant and frequently have twigs and leaves still in the mouth. Less severely poisoned animals may display some nervous signs before succumbing. These typically include trembling, dyspnea and collapse. A sub-acute condition has been recognized, particularly in cattle. The time between ingestion and production of symptoms is as much as two days. In addition to the symptoms listed above, sub-acute cases display signs of gastro-enteritis and diarrhea. The plant is known to contain a volatile oil which appears to be a slowly acting irritant. Post-mortem examination of sub-acutely poisoned livestock reveals moderate irritation in the upper digestive tract. The bright fruit is attractive to children. The pulp is not especially poisonous but the seed may contain dangerous concentrations of poisonous alkaloids.

Western yew (T. brevifolia) has a reputation of toxicity (Canada Department of Agriculture Bulletin 88 (n.s) 1927 and California Agri. Exp. Sta. Bulletin 593 Rev. 1942) but conclusive cases do not appear to have been recorded.