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Characteristics
and
Control

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Higgins
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Idaho Agricultural
Extension Service

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PESTICIDE RESIDUES

These recommendations for use are based on the best information currently available for each chemical listed. If followed carefully, residues should not exceed the tolerance established for any particular chemical. To avoid excessive residues, follow recommendations carefully with respect to dosage levels, number of applications and minimum interval between applications and harvest.

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CANADA THISTLE

Identification and Control

ROBERT E. HIGGINS and LAMBERT C. ERICKSON*

Canada thistle is the No. 1 perennial noxious weed in Idaho. It is a native of Europe and probably was introduced to this country in horse feed by Burgoyne's army about 200 years ago. It is commonly found in all northwestern states. It infests about 200,000 acres scattered throughout the State of Idaho. The heaviest infestations occur in the upper Snake River Valley and in Northern Idaho.

Canada thistle (*Cirsium arvense* L.) is easy to identify. It has spiny leaves and stem, purple to white small flower heads, and creeping, underground root stalks. It grows 2 to 5 feet tall, usually taller than oats, wheat, or barley and often forms dense patches in farm fields. The edges of the leaves usually have many indentations. The spines extend from the outer edge giving a spiny, ruffled appearance. The underside of the leaf is usually a lighter green than the upper side. This is due to numerous hairs on the underside.

The flowers are borne only at the top or at the tip of its branches. Male and female flowers are usually produced on separate plants but sometimes may occur in the same flower head. At maturity, the female flower head fluffs out to produce a cotton-topped appearance while the male flower turns dry and brown. Buds, flowers and seed may be found on a plant at the same time.

Canada thistle has elongated gray-brown seed with a downy parachute attached. The down breaks off readily on threshing, leaving the seed which is especially difficult to separate from alfalfa, clover and grass seeds.

A thistle patch can start from a single seed or root segment. In this case the whole patch will be made up of only male or female plants. Male patches and widely isolated female patches may not set seed. Usually the infestations are mixed male and female plants. Although seed is not always produced abundantly, even when pollination takes place, it usually germinates readily. Thistle seed remaining in crop seed samples has germinated up to 80 percent.

The root system of the thistle enables it to spread more rapidly than most other perennial noxious weeds. The natural spread may be as much as 10 feet per year. Lateral roots develop 8 to 10 inches below the surface of the ground. From these lateral roots new plants develop every few inches to a foot or more apart, depending upon the growing conditions. The new plant is a rosette which lies flat on the ground. It may not produce flowers until the second year. Vertical roots reach a depth of 7 to 10 feet.

Canada thistle grows best on deep, fertile soil. It is not as vigorous on poor shallow soil. However, it is more difficult to eradicate when growing under poor conditions.

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Spread

Canada thistle has been introduced to most areas as an impurity in seed. However, it is spread by wind, water, birds, animals and farm equipment. Man has been responsible for most of this spread. Wind will aid in spreading the seed from a single patch to infest an entire field. Some field tests have shown that about 10 seedlings per square yard appeared for 3 years

after the parent plants were killed. These seeds may have been in the soil or they may have been blown in from the surrounding infestation. The seedling problem probably develops from seed from the surrounding area. Greenhouse tests have indicated that seed carried over in the soil is not apt to be a major problem.

Seed Law

The Idaho seed law prohibits sale of any seed containing seed of any primary noxious weeds. Canada thistle is classed as a primary

noxious weed. All crop seed must be tagged to show that it is free of noxious weed seeds.

Control

Canada thistle can be controlled and eradicated with chemicals, by cultivation, or by cropping practices. A combination of these usually gives the best results. The method and materials depend on the size of the infestation and the conditions under which the weed is growing.

Chemicals

A selective spray of 2,4-D is the most economical chemical for the control of large infestations. When 2,4-D is used, infested fields should be planted to grain, or to grasses for hay or pasture.

In an irrigated area, spring-sown barley or wheat is a good competing crop. Increase seeding rates 10 to 25 percent and fertilize with 40 to 80 pounds of available nitrogen per acre to improve the competition from the grain. (See *A Fertilizer Guide For Idaho Farmers*, Ext. Bul. 325.) Spray with 2 pounds of 2,4-D amine in 30 to 50 gallons of water per acre. The spray should be applied before the grain is in the boot stage. This will avoid injury to the grain and give the best thistle kill. The thistle regrowth should be resprayed again after

the grain is harvested. Use a rotation providing for a grain crop for three consecutive years to permit repeated selective spraying. (See *Control Canada Thistle For Greater Profits*, Exp. Sta. Bul. 321.)

Under dryland conditions, the use of 2,4-D in grain is not as successful as it is under irrigation. Only one spraying a year is usually possible. In winter wheat the spraying must be done just as the wheat starts into the boot stage. When it is at this stage the thistle is too small for best results. Maintaining high fertility will improve results.

One of the best practices for thistle control is seeding infested fields to grasses to be cut for hay. Mow the fields for weed control 8 weeks after seeding. In the second year spray when the thistles are in the tight bud stage; that is, before they show any color. Apply 40 to 120 pounds of actual nitrogen each year to keep the grasses growing vigorously. Leave in grass for 3 or more years.

Amitrol (ATA, ATZ) (3 amino 1,2,4 triazole) should be used only for small patches on non-crop land. Avoid spraying where it will drift

to food or feed crops or where livestock will graze. Spray 8 pounds of 50 percent amitrol per acre in 50 to 150 gallons of water. Make the application when the thistles are 6 inches high to early bud stage. Spray regrowth with 2 pounds of amine 2,4-D per acre. Amitrol is not selective and will kill or damage most plants. **It is adapted only for spot work.**

Soil Sterilants

Sodium chlorate, chlorate-borate mixtures, or carbon bisulfide (CS₂) will eradicate Canada thistle. They cannot be used selectively in crop fields. Carbon bisulfide sterilizes the soil for 1 year. Sodium chlorate sterilizes for 2 to 5 years. Chlorate-borax mixtures sterilize even longer. The time interval depends on the material and rate used and the soil and moisture conditions in the area. Use sodium chlorate at 3 to 6 pounds per square rod and chlorate-borate mixtures at 12 to 16 pounds per square rod.

Apply soil sterilants in October and November so that the winter moisture will move the material into the root zone of the plant.

Trichloro benzoic acid (TBA), can be used for spot treatment on non-agricultural land. This is a long-lasting sterilant and should be used only as directed by the manufacturer on the container label.

Cultivation

Canada thistle yields readily to a thorough, clean cultivation program. Begin cultivation after harvesting the crop. Plow 6 or more inches deep. This turns under residue and sets the thistle back so that cultivation can continue effectively in the spring. Cultivate every 14-21 days with a duck-foot weeder or other cultivator that will cut off all the plants. Cultivation every 14 days is preferred for dry land areas where it is necessary to conserve moisture. Run the cultivator no more than 4 inches deep. In most areas, Canada thistle will be eradicated after 1 year of cultivation. In short season and poor soil areas it may take 2 years.

Thistle can also be eliminated in cultivated crops by persistent cultivation and hoeing.

Alfalfa as a Control

Dense, well-fertilized stands of alfalfa will eradicate Canada thistle. Where it is possible to cut 3 crops, it will usually take 3 years. This should be followed by row crops or 2,4-D spraying in a cereal crop to kill new seedlings. In areas where less than 3 cuttings are obtained, alfalfa helps in control but will not give eradication unless combined with some other method such as cultivation or grain that is sprayed with 2,4-D.

PESTICIDE RESIDUES: These recommendations for use are based on the best information currently available for each chemical listed. If followed carefully, residues should not exceed the tolerance established for any particular chemical. To avoid excessive residues, follow recommendations carefully with respect to dosage levels, number of applications, and minimum interval between applications and harvest.

(Cover illustration courtesy Oregon State College)
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**SEE YOUR COUNTY AGENT FOR FURTHER INFORMATION
ON WEED CONTROL IN IDAHO**

CANADA THISTLE

Characteristics and Control

**Lawrence R. Pennington, Robert E. Higgins and
Lambert C. Erickson***

Canada thistle is Idaho's most widespread primary noxious weed. It infects about 200,000 acres in the state and two million acres in the Columbia Basin. This native of Eurasia was probably introduced to America as a contaminant in crop seeds by the earliest settlers. Franciscan fathers who attempted to improve the agricultural efforts of the Indians brought it to the Hudson Bay area about 1750. There is good historical evidence that the largest early introduction was in the horse feed used by Burgoyne's army almost 200 years ago. The thistle trail from Montreal to Saratoga, New York, was visible for many years and neighboring states passed laws against its importation.

It was probably brought to Idaho about 1880. Small patches existed near Boise and in Sandpoint in 1896. Presently areas of heaviest infestation are the upper Snake River Valley and northern Idaho. It is best adapted to cool and moist areas and prevails throughout the northern half of the United States.

GROWTH HABITS

Canada thistle typically has spiny leaves and stems, purple to white flower heads measuring one half to one inch across and creeping underground rootstalks. It grows 2 to 5 feet tall, usually taller than oats, wheat or barley.

There are four widely different varieties in the state. These differ primarily in presence or absence of spines on the leaves, on the leaf edges and on the stem. They also differ in flower color, stem color and in the length and density of hairs on both the lower and upper sides of the leaves.

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MALE OR FEMALE

The plants are of one sex, either male or female. Whole patches propagated from a single seed or root piece will therefore be either male or female. The flower heads are usually made up of 50 to 100 flowers. The female heads are longer than the males and at maturity produce fluffy parachutes each with a seed at its base. The male flower heads are darker colored and merely dry to a brown head at maturity. In rare instances, flowers of both sexes may be mixed in a common flower head.

ROOT SYSTEM

A meandering root system grows downward usually to a depth of 4 to 6 feet, and to greater depths under dry soil conditions. Side shoots develop from the vertical root primarily in the upper 2 feet of soil. These grow horizontally and from these lateral roots new shoots and new vertical roots develop every few inches to a foot or more apart. By this system a single root may develop into a patch 4 to 10 feet across in a single season. Our studies show that a piece of root 3 inches long can produce a shoot from 18 inches deep. Over half of our 3-inch root pieces planted 18 to 24 inches deep produced shoots to above the soil surface in 33 days.

SEED PRODUCTION

As the flowers in the female heads mature, the reddish tubular flowers wither and the fluffy parachute develops which aids in spreading the seeds. The parachute most frequently breaks off, leaving the seed in the head or at best carrying the seed for only 5 to 20 feet. Single seeds have been found up to 100 feet from the parent plant. The empty parachutes, however, travel great distances.

Much controversy prevails on the capacity of Canada thistle for producing seed. Ten patches of female thistles in northern Idaho harvested each year for three years, 1963 to 1965, produced seed yields ranging from 82 to 788 pounds of seed per acre.

The germination of these seeds varied widely from year to year. The average after-harvest germination for the samples taken in 1963, 1964 and 1965 respectively, was 70, 10 and 7 percent.

In determining the sex of the seeds from each of the 10 seed sources, it was found that the ratio extremes ranged from 1 male per 4 female plants, to 4 male per 1 female plant depending upon the particular seed source.

SPREAD

Seeds are not carried great distances by wind, nor do plump, live seeds travel far on water surfaces. They can survive for perhaps 2 years in water storage. Consequently it is possible to move Canada thistle seeds in strong water currents and deposit them where they may start new infestations.

The most common and universal method of dispersion to new areas and new fields is as an impurity in crop seeds and animal feeds.

Small infestations in fields are certainly enlarged by occasionally plowing or cultivating through them. Every root or stem segment moved down the field, then properly covered and moistened is capable of establishing itself.

IDAHO SEED LAW

The Idaho Seed Law prohibits the retail sale of any crop seed which contains Canada thistle or seeds of any of our other 14 or more perennial noxious weeds. All seed sold in the retail trade must have a **tag** stating its purity, germination and freedom from primary noxious weed seeds.

EFFECT ON CROP YIELDS

It is well known that Canada thistle competes effectively with crop plants for space, moisture and soil nutrients and consequently reduces crop yields. Experiments have been completed which measured some of these factors on crop yields. A 3-year experiment in an irrigated, low-fertility, Canada thistle-infested field in eastern Idaho showed that: 1) when no weed control or nitrogen treatments were made the average yield of spring wheat was 24 bushels per acre, 2) when treated with 2,4-D the yields increased to 26 bushels, 3) when 80 pounds of nitrogen were added the yield increased to 51 bushels, and finally, 4) when both 2,4-D and nitrogen were applied at 2 and 80 pounds per acre respectively the yield jumped to 68 bushels per acre.

A similar experiment in Montana¹ in higher initial fertility soil gave these results: no treatment yielded 36 bushels, 2,4-D only produced 53 bushels, 50 pounds of nitrogen only gave 42 bushels, and when both the 2,4-D and nitrogen treatments were made the yield jumped to 58 bushels per acre. Can one afford to grow Canada thistle?

¹Hodgson, Jesse M. 1958. *Canada thistle control with cultivation, cropping and chemical sprays. Weeds. 6:1-11.*

CHEMOTYPES

There are many reasons why results from chemical control applications vary among areas and among weed patches in a single field. There is now reliable evidence that numerous strains exist and that these strains vary in their resistance to perhaps all herbicides. For example, a thistle strain may have low resistance to 2,4-D but higher resistance to amitrol or vice versa. These are inherited or genetic differences. However, because the differences can be found only by chemical applications we have named them "chemotypes."

SELECTIVE CONTROL METHODS

Control in Wheat and Barley

In the mentioned Idaho experiments the Canada thistle control results at the end of the fourth year were: 1) Thistles in the non-treated plots increased over 100 percent, 2) 2,4-D at two pounds per acre reduced the thistles 80 percent, 3) 2,4-D plus nitrogen reduced the thistles 98 percent.

In Montana the results were much better. After three years, using 2,4-D at $\frac{3}{4}$ pound per acre: 1) thistles in the non-treated checks had increased 157 percent, 2) 2,4-D alone or with 3) nitrogen reduced the thistle stand 99 percent. Additional research has proved that the great differences in effectiveness of 2,4-D demonstrated in these two studies was due to a relatively resistant and a relatively susceptible chemotype.

Use 2 pounds of 2,4-D per acre just before the boot stage or after the grain is formed.

Control in Oats

Oats are more easily injured by 2,4-D than wheat or barley and consequently, MCPA is frequently substituted for 2,4-D. Use 1 pound 2,4-D per acre or 2 pounds of MCPA when oats are in the growth stages given for wheat.

Control in Forage Grasses

When planning to seed a Canada thistle infested field to a forage grass or grasses, first treat the infested areas with 2 pounds of 2,4-D, irrigate if possible, wait 2 weeks; then plow, prepare a good seedbed and seed. Treat again with 1 pound of 2,4-D not earlier than 8 weeks after the grasses emerge. Thereafter treat with 2 pounds of 2,4-D annually just before the thistles reach the bud stage.

Control in Corn

Treat patches with amitrole or atrazine in fall or early spring. Two treatments of 2,4-D amine may be necessary during the growing season: the first when corn is 18 inches tall, the second after the silks have dried. Use directed sprays to avoid corn damage.

Control with Alfalfa

Proceed initially as when seeding forage grasses. Wait 3 weeks after irrigating before seeding the alfalfa. Make certain to apply the necessary phosphorus (100 pounds P_2O_5 =44 pounds P per acre) before plowing. Use maximum seeding rate. Dense alfalfa stands properly irrigated, fertilized and mowed 2 to 3 times annually will eliminate Canada thistle in about 3 years.

NON-SELECTIVE CHEMICAL CONTROL METHODS

The possibility of obtaining good Canada thistle control with two or three applications of 2,4-D or amitrole in a single growing season should be considered for non-crop areas or in the alternate non-crop year.

Apply 2,4-D at 4 pounds (one gallon) per acre each time the thistles reach 12 to 16 inches tall.

Amitrole is sometimes more efficient than 2,4-D. It can also be applied twice or more per season on non-crop land. Apply it at 8 pounds of the 50 percent commercial product. Do not seed these areas until 8 months after the last application.

Another useful method is this. Following an early (August) harvest, irrigate immediately to promote regrowth. When the thistles reach 8 to 12 inches apply either 2,4-D at 4 pounds or amitrole at 8 pounds of commercial product. Following amitrole always wait 8 months until seeding.

Sodium chlorate and chlorate-borax mixtures will eradicate Canada thistle. Sodium chlorate sterilizes for 2 to 5 years; chlorate-borax mixtures will sterilize even longer. Borax is a long-term sterilant to certain crop plants and should therefore be used with caution. The sterility interval depends on the material and rate used and the soil and moisture conditions in the area. Use sodium chlorate at 3 to 6 pounds per square rod, chlorate-borax mixtures at 12 to 16 pounds per square rod. These sterilants should be applied in October or November so that the winter moisture will move the material into the root zone of the thistles.

Carbon bisulfide is a short-term sterilant (for one growth season). It is necessary to plow and harrow to cut the roots and smooth the soil surface before injecting this volatile liquid. The sterility

usually lasts for 3 months. The most successful applications are made in May before the soil moisture has been excessively depleted.

Trichlorobenzoic acid (TBA), picloram (Tordon), monuron (Televar) and others can be used for spot treatment. These are long-lasting sterilants and should be used only as directed by the manufacturer on the container label.

CULTIVATION

Canada thistle can usually be eradicated in one year by a thorough, clean cultivation program. Begin cultivation after harvesting the crop. Plow 6 or more inches deep. This turns under residue and sets the thistle back so that cultivation can continue effectively in the spring. Cultivate every 14-21 days with a duck-foot weeder or other cultivator that will cut off all the plants. Cultivation every 14 days is preferred for dry land areas where it is necessary to conserve moisture. Run the cultivator no more than 4 inches deep. In short season and poor soil areas it may take 2 years for eradication. Apply chemical treatments in subsequent crop years to destroy young seedlings.

Thistle can also be eliminated in cultivated crops by persistent cultivation, hoeing and chemical treatments.