Canada Thistle

Biology and Control

Canada thistle *(Cirsium arvense)* is one of the most prevalent and serious noxious weeds in Idaho crop and noncropland areas. It is classified as a noxious weed in 34 states, and Idaho leads all reporting states in estimated infested acreage. Canada thistle infests all of Idaho's 44 counties.

Canada thistle was brought to America from Eurasia in seed, feed, and animal bedding. Some have intentionally cultivated this plant because of its flower, and honey producers like it for the nectar. Control is difficult because of the plant's perennial root and abundant seed production, and its widespread and diverse habitat.

Identification and Biology

Canada thistle is a perennial that can propagate by seed and roots. Seed can be transported long distances via contaminated grain, on equipment, and by water. Local infestations expand from blowing seed and when lateral perennial roots spread and produce new shoots. Canada thistle usually occurs in patches. Uncontrolled patches expand until a field becomes completely infested. Plants are spiny with deeply lobed leaves and several branching flower stalks. Flowers are about ½ inch in diameter and are normally pink, but can vary in color from white to purple. Flowering plants can reach heights from 4 to 5 feet.

Flowering and Seed Propagation

Not all flowers produce seed. In fact, male and female flowers are usually on separate plants. Both types of flowers will produce white plumes (or pappi) that blow throughout the countryside in the summer. Only plumes from pollinated female flowers will contain seeds, and only those produced under good growing conditions generally are viable. Male and female plants must be located within a few hundred yards of each other for insect pollination and seed set to occur. Fertile, pollinated heads may produce up to 100 seeds; a large plant with 50 heads could produce up to 5,000 seeds. Seed viability the first season may be as high as 90 percent. Some seeds remain viable for 20 years. Irrigation water and rivers are common methods of Canada thistle seed dissemination. Seeds that have been in water for several months can still be viable. Flowering is triggered by long days – over 15 hours of light. Canada thistle flowering and seed production will be limited or prevented in regions with shorter days. Early in the spring, plants remain short until long days trigger stem elongation, normally in May and June. Regrowth in the fall does not usually produce flowers.

Root Propagation

Roots are a major propagation organ of Canada thistle. Within 3 weeks after germination, a seedling root can begin producing buds that can eventually produce new shoots. Although older literature often incorrectly refers to rhizomes on Canada thistle, the underground storage organs that over winter and generate new shoots are roots. New shoots can be produced from Canada thistle roots at any location along the root length. Bud development on the root is controlled by internal hormones and external environment such as temperature, soil fertility, soil moisture, and day length.

Roots can spread 10 feet per year radially from a single plant, and may eventually penetrate in the soil as deep as 15 feet. Most roots, however, will develop in the upper 2 feet of the soil. Any part of the root, even as small as a ½-inch long, can produce buds that will develop new shoots. Hence, as roots are chopped by tillage equipment, each root section can produce new plants. In fact, cutting will result in more plants since each section will normally produce a new plant. The buds have no seasonal dormancy, but some root buds may be kept dormant for a time if other shoots are already present on the root. Extent or timing of new bud development depends on proper environment and the number of other shoots or buds already present.

Ecotypes

Canada thistle leaf shapes, flower color, and response to environmental conditions can vary considerably, even within a geographical region. Each distinctly different variant is called an ecotype. Ecotypes collected in several states have been grown, studied, and partially characterized under a single experimental environment. Such ecotypes will usually retain their distinct characteristics. They may flower at different day lengths, require different temperature for optimum growth and development, and respond differently to herbicides.

Environmental Influences on Physiology

Canada thistle is adapted to a wide range of soil types and environmental conditions. Sandy and heavy clay soils will support the plant, but it is best adapted to heavier soils. Extended periods with temperatures over 90°F will reduce plant vigor and generally limit growth. High temperatures and day lengths less than 15 hours prevent Canada thistle from thriving in the southern part of the United States. Optimum growth conditions are day/night temperatures near 77° and 59°F, good soil fertility with nitrogen levels between 14 and 30 ppm, and medium soil moisture. Warm air temperatures, high soil nitrogen levels, and long days favor foliage growth and flowering. Root growth is favored by moderated soil temperatures of 60° to 75°F, air temperatures below 70°F, day lengths less than 15 hours, and low nitrogen levels. The fall season in Idaho and northern Utah corresponds closely to the latter environment. Root growth in Idaho continues late into the fall, even after several frosts, until the leaves die. Overwintering success of roots depends on sufficient energy reserves and on cold temperature conditioning, which prepares plants biochemically to live through freezing temperatures. Carbohydrate reserves are depleted in the spring and at other times when new emerging shoots use energy from the roots. Energy depletion will continue until enough leaves are present to produce food for the growing foliage. Most sugars produced by photosynthesis during spring are used for plant growth, heading and flowering. Little replacement of root reserves occurs until plants are about 1-foot tall. Repeated mowing or tillage will further deplete root energy reserves because

regrowth will use additional root energy. Fall environmental conditions usually promote accelerated root, shoot, or bud production in the soil with little or no apparent foliage growth. Leaves have to be present in the fall for this root growth to occur, but sugars produced by photosynthesis go to the roots rather than into large numbers of new leaves.

Interference with Crops

Canada thistle reduces crop yield through competition and allelopathic factors. Canada thistle releases toxic chemicals into the soil that inhibit growth of other plants. This is called allelopathy. Roots and shoots of Canada thistle allowed to decay in the soil have reduced growth or vigor of sugarbeets, wheat, alfalfa and seedlings of Canada thistle. Allelopathy can be in reverse, as well, where a desirable plant may inhibit Canada thistle. Where Canada thistle stands are dense, crop yields may be near zero. Pasture grass, corn and wheat production have been reduced 60, 57 and 50 percent, respectively, in research studies where Canada thistle density was moderate. Canada thistle interference is also significant in rangelands because forage production may be reduced and animals may avoid infested forage. Recreation areas that are infested with Canada thistle are much less desirable than those without this weed.

Control

Control is feasible with vigilance and determination. An integrated approach with good management of the crop, cultivation, and herbicides will be most effective. A cooperative effort by all landowners is necessary to reduce Canada thistle infestations. Long-term control of Canada thistle can only be achieved by elimination of seed production, seedling growth, and established perennial plants. Since seeds can remain viable in the soil for several years, seed production must be prevented. New seedlings must be sprayed or cultivated within 2½ weeks of emergence so they will not become perennial. Any treatment to control the perennial plants will usually take more than 1 year.

Cultivation alone has been shown to control the perennial plants when tillage is started at flower bud time (when root energy reserves are low) and continued every 10 days through the season. To be successful, this practice must be repeated the next year. Late fall moldboard plowing will bring some roots to the soil surface where they are exposed to freezing and desiccation. Late fall plowing can also delay Canada thistle emergence in the spring by 3 to 5 weeks since late fall-production shoots are destroyed.

Crop interference can also control Canada thistle. A heavy, vigorous alfalfa crop mowed at least three times per year will weaken the thistle roots by depleting carbohydrate reserves and will eventually suppress Canada thistle growth.

Some biological control agents (diseases and insects) have been found to suppress Canada thistle to a limited extent. Insects have stopped flowering certain years, and leaf rusts have reduced vigor. Research is continuing on biological control agents, but potential for control from these agents is limited at present.

Several herbicides effectively control Canada thistle, but results can vary for several reasons. Some thistle ecotypes may be more susceptible to certain herbicides than other ecotypes. Growth stage of the thistle or season of year also influences plant susceptibility. Improper application method, incorrect herbicide rate, or poor calibration also account for much of the variability. Using the same herbicide for several successive years increases the possibility of developing a tolerant variety from the original Canada thistle stand. **Always follow directions on the herbicide label.**

Optimize Control

Under irrigated conditions, the best control of established Canada thistle will include a fall herbicide treatment following irrigation. Dryland Canada thistle control may be best at flower-bud stage in early summer.

Principles for improving fall Canada thistle control:

1. **Weaken roots.** Weaken the roots and deplete root carbohydrate reserves. To weaken the root, suppress Canada thistle growth during summer either through herbicide treatment, vigorous crop growth, or by mowing or tilling several times.
2. **Promote shoots.** Obtain as many foliar shoots per root quantity as possible if foliar herbicide is to be used. This allows more herbicide to be taken up by the plant and moved into the root area. Late summer tillage to chop roots will increase the number of foliar shoots and the leaf area per root in the regrowth.
3. **Maximize growth.** The weed must be growing rapidly for maximum herbicide action. Disc or till all old foliage in late summer, but no later than September 5. Irrigate immediately after the last tillage, and allow new growth to occur for 3 to 5 weeks. Keep the soil moist until herbicide treatment. Promote new growth by maintaining adequate soil moisture and soil fertility.
4. **Apply suitable herbicides.** Translocated herbicides such as glyphosate and dicamba, alone or in combination with 2,4-D, should be applied to new growth when leaves are green (in September or October). Herbicides can be applied after several frosts unless the leaves die. *Do not apply to old leaves or drought-stressed plants.*

Under the optimum control conditions, herbicides will be readily absorbed into the plant because new leaves have not yet developed a thickened cuticle to resist herbicide penetration. As an additional benefit of fall timing, herbicides together with the sugars produced by photosynthesis will move rapidly into the roots because the plants are storing energy reserves at this time of year.

The key is to make sure the plants are growing well, even if foliage or leaf number is not increasing greatly. As long as the leaves are green, photosynthesis and root growth are continuing. Good soil moisture is especially important for glyphosate. The next best application time for most herbicides is at flower/bud stage. Generally, root energy reserves are lowest at that time, and good spring moisture will promote rapid growth.

For more information please contact:

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