

Organic Management of Canada Thistle

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▲ **Canada thistle flower and buds**
(P. Gregoire, NDSU)



▲ **Seed head of Canada thistle displaying seeds with feathery pappus**
(E. Burns, NDSU)



▲ **Canada thistle leaf upper surface; note that it is smooth**
(P. Gregoire, NDSU)



► **Underside of Canada thistle leaf**
(P. Gregoire, NDSU)

Canada Thistle Biology and Identification

Canada thistle (*Cirsium arvense* (L.) Scop.) is a long-lived perennial weed that spreads rapidly due to the generation of new shoots from creeping, extensive roots. This species was introduced to North America probably as a contaminant in seed or forage.

Oblong, deeply lobed dark green leaves with spiny margins clasp the stems in an alternate arrangement. The leaf surfaces are smooth to slightly hairy. Unlike other exotic thistles in North Dakota, Canada thistle does not have a highly spiny stem.

Small ($\frac{3}{4}$ inch diameter), composite flowers are borne at the tops of stems. Flowers vary from purple to pink, and are less commonly white. Seeds are light brown and have a featherlike pappus, which aids in wind dispersal. Seeds can be dispersed long distances by the wind, but most seeds tend to fall near the mother plant.

Canada thistle rosettes emerge in early spring once the soil temperature reaches 35 to 45 F. Flowering occurs from June through September.

North Dakota's Noxious Weed Law

Canada thistle is on the North Dakota noxious weed list. What does this mean? A North Dakota law (NDCC § 4.1-47-02) requires every person to "do all things necessary and proper to control the spread of noxious weeds."

The North Dakota Department of Agriculture coordinates the efforts of county and city weed boards and state and federal land managers to implement integrated weed management programs. To access city and county lists and find out more

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about North Dakota's noxious weed law, visit the North Dakota Department of Agriculture website: www.nd.gov/ndda/program/noxious-weeds.

The North Dakota Century Code states that noxious weeds must be controlled and that control is defined as "preventing a noxious weed from spreading by: A) suppressing its seeds or propagating parts or B) destroying either the entire plant or its propagating parts." The method by which control is achieved is not specified nor is it limited to herbicides.

Organic farmers face a serious challenge when controlling Canada thistle and other noxious weeds, but insisting that noxious weeds must be controlled by synthetic herbicides is incorrect. Effective nonchemical methods are valid options for noxious weed control in North Dakota.

Problems Caused by Canada Thistle

Why is Canada thistle such a concern in North Dakota? This aggressively spreading weed is the most common noxious weed in the state and infests millions of acres. The ability of this species to reproduce via vegetative shoots leads to dense infestations that compete with and crowd out desirable native plants or crops.

If you see a dense patch of thistle in a field or pasture, chances are good that this is Canada thistle. And even though the species is poorly dispersed via seed, just one seed can produce a new patch. New patches can spread quickly if control measures are not taken.

Canada thistle can displace endangered or threatened plant species. In pastures, Canada thistle is a deterrent to grazing because cattle avoid eating the spiny leaves. Grazing Canada thistle with goats is a control option because goats tolerate and often prefer spiny, tough fodder that other livestock reject.

Canada thistle infestations in lawns are undesirable and may reduce property values. In rangeland, Canada thistle may cause changes in fire frequency and intensity, leading to ecological disruption.

Unlike many noxious weeds, Canada thistle also is a serious problem in cropland, especially in organic production systems. If an organic farmer is unable to prevent the spread of this noxious pest, he or she may be forced to choose between organic management and weed control. Canada thistle infestations can cause substantial yield losses in most annual field crops.

OMRI-approved Products for Use in Organic Systems

Synthetic chemical herbicides often are used to control Canada thistle, but these products are not allowed for use on certified organic land or land transitioning to certified organic production. However, Organic Materials Review Institute (OMRI)-approved weed control products are commercially available and can be used to suppress Canada thistle.

One commercial preparation contains the active ingredients citric acid and clove oil. The active compound in clove oil is eugenol, which disrupts cell membranes, leading to tissue death. Acetic acid (vinegar), caprylic acid and other organic acids are contact-type herbicides that burn plant tissues. These organic acids are the most common ingredients in many organic weed killers.

Research conducted to assess the effectiveness of these natural products has yielded mixed results. In general, these products can kill small annual weeds, but the effectiveness varies widely among weed species. Generally, broadleaves are better controlled than are grasses, but the key is spraying small (less than 2 inch) weeds. Results from one study showed that acetic acid effectively burned and destroyed Canada thistle shoots, but the plants readily regrew from roots.

Repeated applications eventually may control small Canada thistle patches, but multiple years of treatment are usually necessary. Organic acid herbicides usually require very high carrier volumes (30 to 100 gallons/acre) and high application rates to be effective.

These use requirements, combined with a high per-gallon cost, make OMRI-approved herbicides cost prohibitive for broadcast application in most agronomic crops grown on large acreages. However, spot treatment can be more practical and cost-effective.

Another issue with these OMRI-approved herbicides is that they are nonselective, meaning they can damage crop and weed species, so in-crop application is usually not possible.

Biological Control Agents for Canada Thistle

Various insects, as well as bacterial and fungal pathogens, attack Canada thistle. Two non-native insects that feed on Canada thistle have been studied and widely released in North Dakota as biological control agents.

The first is *Hadroplontus litura*, a stem-mining weevil. This insect emerges as an adult in the spring, feeding on thistle leaves and depositing eggs. Larvae migrate into the stems, where they mine the pith, eventually exiting into the soil, where they pupate. Although the larvae may feed on the roots briefly, the damage is mostly confined to the shoots, so the plants easily recover.

The second released insect is *Urophora cardui*, a fly that lays eggs on the plant. The presence of larvae causes the plant to form a woody gall on the stem, which directs nutrients away from the growth of the plant. However, like the weevil, the gall fly inflicts little lasting damage and has not reduced Canada thistle infestations substantially when used alone.

Two pathogens (*Puccinia punctiformis* and *Pseudomonas syringae* pv. *tagetis*) infect Canada thistle, but attempts to develop effective commercial products from these have failed. Canada thistle infected with fungal pathogens exhibit white or yellow upper leaves.

When combined with other control methods, biological control agents may help reduce Canada thistle infestations to a minor degree. For example, insect feeding can give pathogens an entry point. Some growers report that mowing a *Pseudomonas*-infected thistle patch immediately before a rain can help spread the fungus and increase infection.

Overall, biological control agents have limited ability to control Canada thistle infestations when not used in combination with other control tactics.

Mechanical Control of Canada Thistle

The primary reason Canada thistle is difficult to manage is its extensive root system that stores carbohydrate reserves and allows the plant to regrow after shoots have been destroyed. Because of this system, long-term control of this weed requires methods that destroy the roots or exhaust them of their carbohydrate reserves.

Tillage and mowing are two mechanical tactics that can exhaust these tenacious root systems. Timing and frequency of mowing are important to achieving acceptable levels of suppression. Mowing should start at early bud stage to prevent seed production. The plants should be cut as short as possible, with repeated mowing as plants regrow.

Persistence is key. Several years may be required to deplete the root stores.

Adding alfalfa to an annual crop rotation and mowing it for hay can suppress Canada thistle. Repeated tillage also will weaken the roots through time.

You must use an implement that will sever the shoots completely from the roots. Because thistles regrow, tillage should be repeated frequently, or at least every three weeks. Otherwise, tillage will make the problem worse because Canada thistle can regenerate from even small pieces of roots if conditions are favorable.

The roots are susceptible to frost damage, so repeated tilling late in the fall can help kill roots by bringing them to the surface.

Whether mowing or tilling, these methods rely on severing the shoots from the roots to weaken the roots.

Cultural Control of Canada Thistle

Prevention and sanitation are important for limiting Canada thistle spread. Plant clean seed, especially forages, and do not allow patches to produce seed. After tilling thistle-infested areas, clean equipment to prevent it from carrying root fragments into clean fields. Even a tiny root fragment can produce a new plant.

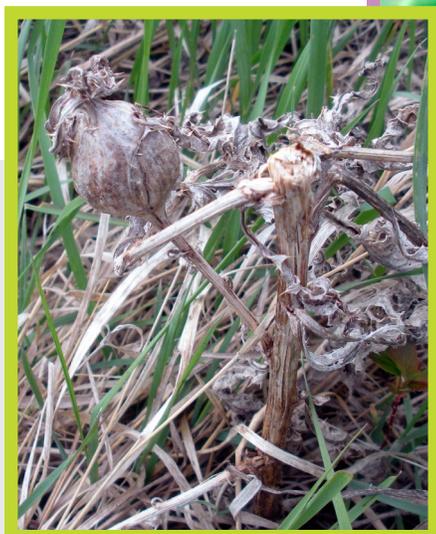
Scout clean fields for new patches. You often can remove a small patch completely if you dig it up carefully and remove the roots.

Canada thistle does not tolerate shading, so establishing vigorous, healthy crop stands is key. Maintaining good soil fertility is another tactic to help foster the growth of desired plants instead of Canada thistle. The best crops for outcompeting Canada thistle are winter annual cereal grain crops and perennial crops such as alfalfa or forage grasses.

However, competition alone seldom will provide long-term control. Combining competitive crops with mowing, tillage or grazing may increase success. Grazing with goats also can provide suppression of Canada thistle.

Target grazing to the bud stage, when flower buds are present but not yet open, because this will ensure the goats take the maximum amount of energy reserves possible from the thistle and prevent seed set. A dense patch of thistle may need to be grazed more than once during the summer to prevent seed set.

The key to using crop rotations to manage Canada thistle is growing crops with different life cycles than the weed.



▲ Canada thistle gall (G. Gramig, NDSU)



▲ *Hadroplontus litura* stem mining weevil feeding on Canada thistle leaves (E. Burns, NDSU)



◀ Canada thistle flower bud (E. Burns, NDSU)

For instance, alfalfa works well because it emerges and starts growing in the spring about three weeks earlier than Canada thistle. After cutting, alfalfa recovers more quickly and continues to grow tall in the fall, when Canada thistle remains in a rosette.

Narrow row spacing or undersowing a cash crop with a cover crop such as red clover also can increase competition. Seeding a highly competitive cover crop such as winter cereal rye after a season of frequent tillage and cutting in the spring also is an option for suppressing Canada thistle.

Crop rotations should balance crops that compete well, such as alfalfa and winter wheat, with crops that compete poorly, such as soybeans or corn. Avoid growing a simple corn-soybean rotation. Using a high-residue cultivator in wide-row (30 inches or greater spacing) corn or soybeans can provide in-season Canada thistle suppression.

Wildlands, Pasture, Rangeland and Roadsides

Early detection also is important in perennial systems such as wildlands, pasture and range. A small patch of Canada thistle can be controlled more easily than a large infestation.

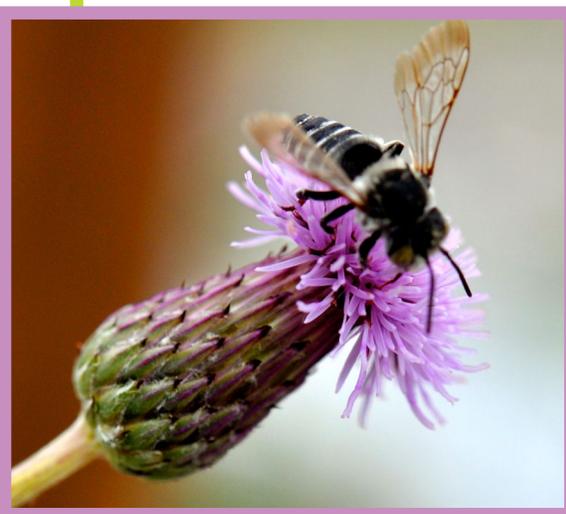
Canada thistle thrives in disturbed soil, so preventing disturbances in wild areas, pasture and rangeland can limit its spread. Overgrazing pastures or rangeland also encourages the spread of this weed.

Canada thistle does not do well when shaded, so maintaining a cover of desirable plant species will help suppress Canada thistle and prevent establishment. Revegetate disturbed areas immediately. Strategic grazing and mowing before flowering can prevent further spread.

Prescribed fire often is used to encourage native plants, but fire has not been shown to control this weed effectively. Biological control agents may provide some suppression in pasture and range settings.

Despite its many problematic attributes, Canada thistle can provide nectar to native pollinators, a needed service in many landscapes dominated by grasses.

▶
**Pollinator feeding on a
Canada thistle flower**
(E. Burns, NDSU)



Summary of Best Practices to Control Canada Thistle

Remember: Canada thistle is an aggressive and hard-to-control weed because it easily regenerates shoots from its extensive creeping root system. Without the use of synthetic herbicides that kill these roots, you must rely on methods that deprive the roots of additional energy that is produced by the leaves.

Organic management of Canada thistle relies on 1) **prevention** and 2) **depletion of root energy reserves**. Organic farmers should plan to use a combination of biological, mechanical and cultural tactics to manage Canada thistle.

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