

Canada thistle

Cirsium arvense (L.) Scop.

Canada thistle is native to southeastern Europe and the eastern Mediterranean region, and was introduced to North America before 1800. It is probably the most widespread of all thistle species and was likely introduced in ship ballast and as a seed contaminant. Canada thistle spreads rapidly; its extensive root system and clonal nature allow it to form monocultures, altering community structure, outcompeting native species, and reducing biodiversity. It also can threaten rare and endemic species. Healthy natural communities offer some resistance to invasion, but Canada thistle poses a particular threat to degraded sites and newly restored grasslands.

Canada thistle also has a significant economic impact on crop and rangeland. Most livestock will not eat thistle and their selective grazing facilitates its dominance in pastures. It can even scratch grazing animals, resulting in small infections. It reduces crop yield through competition for resources including sunlight, nutrients and water. It is a host for a number of agricultural pests such as bean aphid, sod-web worm, which attacks corn, and stalk insects that damage tomatoes.

Identification

Habit:

Canada thistle is a spiny herbaceous perennial that ranges from 0.3–1.5 m (1–5 ft) in height. It has an extensive network of creeping roots that reach deep into the ground, and it forms extensive clones.

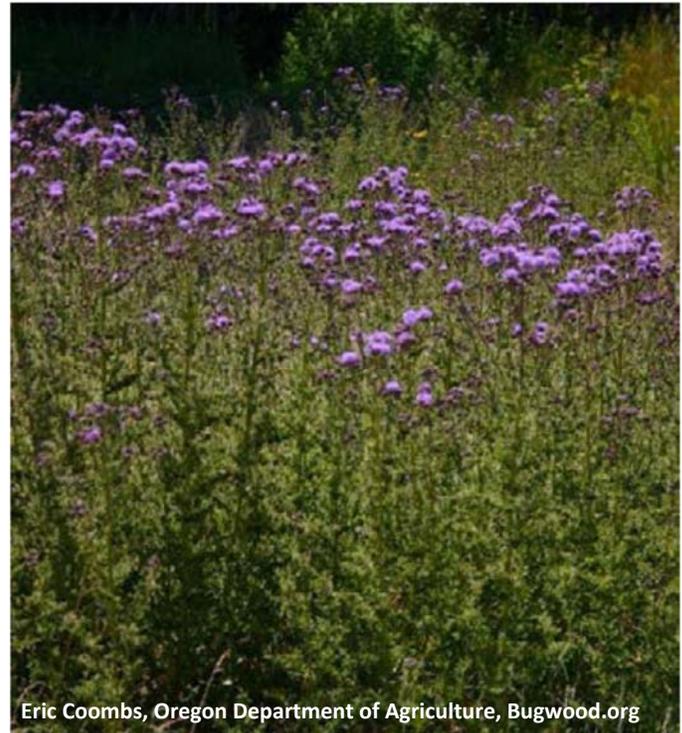
Leaves:

Canada thistle has lobed leaves with spiny teeth. Plants that grow from seed initially develop a basal rosette of leaves. Later in their first year, they send up a stem with alternate leaves. The leaves are highly variable.



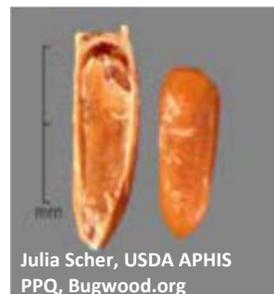
Bark/Stems:

Canada thistle's stems are smooth, with shallow lengthwise ridges. They branch near the top of the plant. They do NOT have spines and are not winged.



Flowers:

Canada thistle's lavender, pink or white flowers are held in a structure called an involucre, composed of bracts called phyllaries. Some phyllaries may have tiny spines. Male and female flowers are held on separate plants and clones consist of a single sex.



Fruits/Seeds:

Canada thistle has small dry tan seeds called achenes. They are attached to a feathery bit of fluff which helps them disperse in the wind. Only female plants produce seed.

Habitat:

Canada thistle thrives on sunny disturbed sites such as roadsides, ditches, pastures and hayfields. It also invades natural areas including prairies, barrens, savannas, glades, sand dunes and meadows.



Similar Species

Canada thistle's perennial status, clonal growth and small flower heads distinguish it from other thistles in Michigan. It is also shorter; typically knee to waist high, although it can reach six feet. It does not have winged or prickly stems.



Eric Coombs, Oregon Department of Agriculture, Bugwood.org

Canada thistle



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Canada thistle

The invasive European marsh thistle (*Cirsium palustre*) has small clustered flowers, however it is a much taller, scraggly plant and its stems are prickly.



P. Higman

European marsh thistle



P. Higman

European marsh thistle

The invasive bull thistle (*Cirsium vulgare*) has much larger flowers and its stems are also prickly.



Loke T. Koke, VA Polytechnic Inst & State Univ, Bugwood.org

Bull thistle



L. Wallis

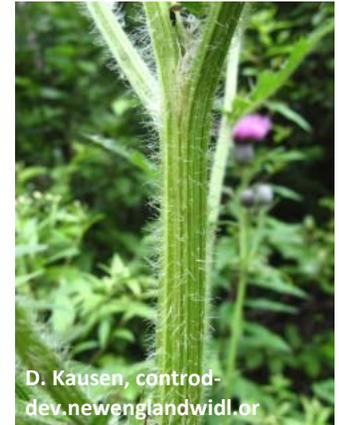
Bull thistle

The native swamp thistle (*Cirsium muticum*) is not clonal and has larger, flower heads with cobwebby, somewhat sticky involucre. The flowers are a deeper shade of purple.



Liana May

Swamp thistle (native)



D. Kausen, controd-dev.newenglandwidl.or

Swamp thistle (native)

Reproduction/Dispersal

Canada thistle is anchored by a deep tap root up to 6 feet long and reproduces through perennial, creeping rhizomes and prolific seed production. The lateral roots can grow as much as 12 feet in a year and new plants can also regenerate from root fragments. Most clones are either female or male, both of which flower from midsummer to early fall. Flowers are pollinated by a variety of insects, including honey bees and wasps. Female flowers produce small, light brown, tapered seeds in the fall that are dispersed by wind, animals, humans, and vehicles. Germination rates are very high and seeds have been shown to remain viable in the soil for twenty years.

Best survey time

Canada thistle is easiest to detect when in flower and fruit. However, its dense clonal clusters, non-prickly stems and relatively short stature distinguish it from other thistles any time during the growing season.

Planning a control effort

Resources for invasive species control invariably fall short of the actual need, so it is important to prioritize sites for treatment and plan carefully. Assessing the scope of the problem is a critical first step:

- Minimize intensive disturbance where Canada thistle is undesirable.
- Map known populations.
- Identify leading edges and outliers.
- Identify potential dispersal pathways and monitor them; is the population along a pathway or stream?



- Does it lie in the path of road-mowing crews that might spread it further? Are there construction sites in the area where it might be introduced in fill dirt?
- How is the species behaving in your area? Is it spreading rapidly?
- Does it occur in high quality habitat or on important recreational, hunting or fishing lands?

Given this information, develop a strategy for control:

1. Prioritize high value sites where treatment success can be achieved.
2. Prevent further spread by monitoring the leading edges and outliers.
3. Choose appropriate control methods, given site conditions and available resources.
4. Determine whether any permits are required (e.g., herbicide application in wetlands, prescribed burning).
5. Eradicate smaller satellite populations.
6. Treat larger core infestations.
7. Monitor to ensure desired results are being achieved; adapt management to improve success.

Documenting occurrences

In order to track the spread of an invasive species on a landscape scale, it is important to report populations where they occur. The Midwest Invasive Species Information Network (MISIN) has an easy-to-use interactive online mapping system. MISIN I-phone and android phone apps are also available. Links to the MISIN and its phone apps are provided in the “On-line resources” section. Herbaria also provide a valuable and authoritative record of plant distribution. The University of Michigan Herbarium’s database can be searched online for county records of occurrence, for example. When Canada thistle is first encountered in a county where it has not been known previously, specimens should be submitted to the Herbarium to document its presence. Check the “Online Resources” section for links to both of these resources.

Control

Canada thistle is notoriously difficult to control due to its’ deep, perennial tap root, fast growing lateral roots and abundant, highly dispersible seeds. The primary goals for control are to prevent seed production, deplete the seed bank, and prevent the arrival of new seeds or rhizome fragments from nearby populations.

Using a variety of techniques including manual, mechanical and/or chemical control is usually most efficient and effective, and should be tailored to the specific conditions of the site. It is critical to monitor

treatment sites for multiple years, perhaps indefinitely, to ensure depletion of the existing seed bank and prevent replenishment of the seed bank from other sources.

It is also important to assess whether there are enough desirable plants in the seed bank to replace the thistle after treatment. Long term treatment efforts should be planned accordingly so that resources are not wasted where successful control cannot be achieved.

Hand pulling

Hand pulling over repeated years can be effective for controlling small populations, but requires diligent, repeated monitoring to ensure the seed bank is depleted. It is usually not practical in large, well established populations, particularly since seeds can remain viable in the soil for twenty years. Hand-pulling can be used as a follow-up to other control methods such as mowing or herbicide application.

Hand-pulling is only effective if the root is extracted, otherwise plants can re-sprout. It should be conducted prior to seed production or it will facilitate seed dispersal. Practitioners recommend pulling when it is in full bud and repeatedly thereafter at 3-4 week intervals, until dormancy in the fall. It may only take several years to eradicate emerged plants; however, depletion of the seed bank will take many more years.

Soil disturbance by hand-pulling also stimulates seed germination. Deliberate stimulation in this way may expedite depletion of the seed bank, thereby speeding up long-term control. However, this will only be effective if follow-up management of new sprouts is undertaken before new seeds are produced. Follow-up treatment will be required for many years.

Pulled plants should be bagged and taken to a landfill or dried and then burned or buried deep into the ground.

Protective clothing, including gloves, should be used to avoid serious skin scratching by the plant’s prickles.

Mowing

Mowing Canada thistle is similar to hand-pulling, but where compatible with management goals, is usually easier and can be conducted over larger areas. It is not an effective control method alone; however, it can suppress thistle growth and reduce the contribution of new seeds to the seed bank.

Mowing should be conducted when plants are in full bud and then a second time as plants begin to flower and produce multiple leaves. Mowing after seed production will facilitate seed dispersal.



Mowing should be considered in the context of overall site conditions and management goals as there may be impacts to desired species.

Mowing prior to July 15 may kill or displace ground nesting birds and this should be considered during planning.

Cutting

For small populations, the flowers can be snipped, bagged and removed; however, this is labor intensive. It must be conducted multiple times during the growing season, due to the long flowering period, and will be required until the seed bank is exhausted.

Intensive cultivation

In sites where management goals allow for intensive cultivation, Canada thistle populations can be reduced over a period of years. However, considerable care must be taken not to spread root fragments into previously uninfested areas.

Cultivation should be conducted about nine days after shoots have elongated, to a depth of 10 cm and repeated at three week intervals. Seeds remaining in the soil will germinate, requiring long-term management.

Grazing

Recent studies show that sheep, goats and cattle can be trained to graze Canada thistle which can reduce flower production and subsequent seed recruitment. In sites with compatible management goals, grazing should occur before full flower-buds develop. Repeated grazing or a combination of grazing with other treatments will be required to deplete the seed bank.

Grazing can also suppress desirable vegetation and this should be considered during planning. If there is not a residual seed bank of desired plants, seeding may also be necessary.

Chemical control

Chemical control is almost always necessary as part of an integrated plan for effective control of well-established Canada thistle.

Careful consideration should be given to selecting sites for chemical application where resources are available to support long-term management. Factors that should be considered when selecting an herbicide for use on a particular site include proximity to water or wetlands, presence or absence of desirable native vegetation, potential for erosion and the effectiveness of the herbicide under consideration on Canada thistle.

Use of herbicides in sensitive or highly valued sites should also be given careful consideration as this may reduce genetic diversity in natural vegetation. While thistle abundance may be reduced more quickly with herbicide application, conservation of the diversity of native species, as well as age and structural diversity, may be more important at some sites.

General considerations

Anyone applying herbicides as part of their employment must become a certified pesticide applicator. In addition, certification is required for the use of some herbicides under any circumstances. The exam is administered by the Michigan Department of Agriculture and Rural Development and a link to their website is included in the “Online Resources” section.

A permit from the Michigan Department of Environmental Quality is usually required to apply herbicide where standing water is present—in wetlands, along streams, rivers or lakes, or over open water. A permit is also required for herbicide use below the ordinary high water mark along the Great Lakes or Lake St. Clair shoreline, whether or not standing water is present. A link to their website is included in the “Online Resources” section.

A number of adjuvants or additives may be used with herbicides to improve their performance including mixing agents, surfactants, penetrating oils and dyes. Some are included in premixed products while others must be added. Adjuvants do not work with all products; consult the product label to determine which adjuvants may be used with a specific herbicide formulation.

Dyes are useful in keeping track of which plants have been treated, as well as detecting spills on clothing or equipment. Some premixed herbicides include them or they can be added to others. Clothing dyes such as Rit® can be added to water soluble herbicides, while other products require oil-based dyes. Consult the product label for specific instructions.

Crop Data Management Systems, Inc. (CDMS) maintains a database of agro-chemicals that includes herbicide labels for specific products. Herbicide labels contain information on application methods and rates, specific weather conditions, equipment types, nozzles, etc., to provide the desired coverage and minimize the potential for volatilization or drift. They also contain critical information about the potential for damage to valuable non-target species. A link to the CDMS website is included in the “Online Resources” section.



Read the entire pesticide label before use. Follow all directions on the label.

Herbicide Specifics

With the exception of glyphosate, herbicides that are currently known to be most effective on Canada thistle persist in the soil for up to one year, requiring manure management and seeding restrictions, or they have the potential to contaminate surface and ground water. Plants treated with these chemicals cannot be composted and treatments cannot be applied in water. Two are included here because they have demonstrated higher and longer-term control efficacy, and may be appropriate for some sites.

Glyphosate (e.g., Roundup Pro[®], Rodeo[®], Accord[®]) can provide some control of Canada thistle, however infestations must be treated repeatedly for at least several years and the seed bank must be managed until exhausted. Use of glyphosate is most practical for small populations during the early stages of invasion. It should be applied as a foliar spray in the bud to early flowering stage or to green rosettes in the fall. Fall treatment will not control seedlings that emerge in the spring and dry conditions may inhibit translocation of herbicide to roots.

Glyphosate should be used with a vegetable oil based multi-purpose adjuvant (e.g. SprayTech[®] Oil) on upland sites or a wetland-approved non-ionic surfactant (e.g., Cygnet Plus[®]) in wetlands. Only aquatic formulations should be used in wetlands or if contact with surface waters is anticipated.

Glyphosate is not selective and will kill desirable non-target species through overspray and drift, in some cases leading to increased erosion on site. Glyphosate works best at temperatures above 50 degrees.

Aminopyralid (e.g., Milestone[®]) can provide effective control as a foliar spray applied to the foliage in spring or fall, or during the bolting stage before seeds ripen. It should be used with a non-ionic surfactant (e.g., Cygnet Plus[®], Nu-film IR[®]) on upland sites up to the water's edge. **It is not approved for wetland use.**

Aminopyralid is broadleaf specific and will not harm well established grasses or sedges; legumes are particularly vulnerable. It persists in the soil for up to a year and in decaying plant material and manure of animals that have grazed on treated lands. There are restrictions on haying and grazing, and manure management is required. Manure should not be composted. Aminopyralid does, however, provide residual control of germinated thistle seedlings for

some time, dependent upon the application rate and site conditions. **Broadleaf plants should not be seeded during this time.**

Clopyralid (e.g., Transline[®]) provides effective control as a foliar spray applied from early bud to early flowering stage or to fall rosettes. Treatment will not control seedlings that emerge in the spring and dry conditions may inhibit translocation of herbicide to the roots. It should be applied with a non-ionic surfactant (e.g., Cygnet Plus[®]) on upland sites. It is not approved for wetland use.

Clopyralid is broadleaf specific and it will not harm well established grasses or sedges. It persists in the soil for up to a year and in decaying plant materials and manure of animals that have grazed on treated lands. Manure management is required and manure should not be composted. Broadleaf plants should not be planted during this time. Clopyralid has the potential to contaminate ground and surface water and should not be used in porous soils or areas with a high water table.

Prescribed Fire

General considerations

Permits are usually required before a prescribed fire. The Michigan Department of Natural Resources (DNR) is responsible for issuing burn permits in the Upper Peninsula and Northern Lower Peninsula unless a municipality wishes to do so. Municipalities located in the Southern Lower Peninsula issue burn permits under authority of the state law. A link to the DNR local fire contacts web page is included in the "Online Resources" section. In the Southern Lower Peninsula, contact the local Fire Marshall for permits and more information. In many situations, insurance is required before a permit is issued, to cover the cost of damages if the fire should escape.

Before initiating a program of prescribed fire, a written burn plan establishing the criteria necessary for starting, controlling, and extinguishing a burn is required. The burn plan includes details such as specific weather conditions, locations of fire control lines, ignition pattern, equipment and personnel needed, contingency plans, and important phone numbers. The burn plan is essentially the prescription for how to conduct the burn safely while accomplishing the management objectives.

Fire Specifics

Spring burning can be useful in fire-adapted communities, but prescribed burning alone does not provide effective control of Canada thistle. Fire will control seedlings if there is adequate fuel, however, its



impact to older plants is variable, depending upon fire intensity. Established plants quickly re-sprout after fire and seed germination is stimulated. This increases Canada thistle's ability to compete with other species.

Deliberately using fire to stimulate germination may be an effective means of more rapidly depleting the seed bank; however intensive seedlings management after burning must be planned. Prescribed burns should not be conducted if this is not possible. Seedlings can be managed by hand-pulling, spot herbicide application or burning with a hand-held propane torch. At least three years of burning are required to suppress well established populations. However, follow-up treatment of new seedlings will be necessary until the seed bank is exhausted, which may take longer.

Fire may pose a risk to desirable plants and this should be considered during planning. However, it may benefit other fire-adapted species such as prairie grasses, which provide increased competition with Canada thistle.

Hand-held propane torch

Freshly emerged seedlings can be quickly killed with a handheld propane torch, but this should be done when conditions are not too dry, to minimize risk of unintentional fire. As the first-year plants develop taproots, this method becomes less effective.

Interseeding

Well established competitive grasses can help suppress Canada thistle and seeding with grasses may be useful. Seeding of grasses and broadleaf plants must be timed to correlate with residual soil activity of herbicides applied.

Seeding methods depend on the species, with trade-offs usually occurring between fall and spring seeding. A cover crop of grasses, such as annual rye, could be used in combination with control via broad-leaf herbicide.

Non-agricultural sites could incorporate native wild ryes (*Elymus*) to promote competition and infection by phytopathogens for use against Canada thistle.

Biological control

Dozens of biocontrol agents, both native and non-native to North America have been considered for treating Canada thistle, none of which have provided very effective control. Several that are most likely to have significant impacts on Canada thistle are generalist feeders and are not suitable for release.

One species, *Larinus planus Frabicius*, which was inadvertently introduced to the US, has been

distributed in the western range lands for thistle control. This seed eating weevil was documented feeding on the state and federal threatened Pitcher's thistle (*Cirsium pitcheri*) in 2012. Surveys of known Pitcher's thistle populations in Michigan are currently under way to assess and document its impact.

Integrated control

Integrated control first requires an understanding of the site management goals, the biology of Canada thistle and the environment in which it is growing. This information confers a combination of actions that collectively reduces its impact. Canada thistle is a colonizing species of areas where there was recent disturbance and poor establishment of desirable species. It grows where there is altered soil microbial and faunal activity and hydrology.

Well-timed and repeated mowing, chemical application, or prescribed fire is often implemented in conjunction with follow-up hand-pulling, spot chemical treatment, or burning with a hand-held propane torch. Due to the long-lived seed bank, follow-up will usually be required for many years.

Natural area managers are encouraged to work with features on their local landscape that would contribute to the overall reduced impact and spread of Canada thistle. For instance, managers could intentionally allow succession to proceed with shrubs and trees as an alternative way to restore ecological health over a longer period of time (years). Other options may include introducing competitive plant species in combination with control. Managers could also consider higher thresholds of tolerance for Canada thistle in order to rebuild soil biology and properties and then pursue control efforts.

Disposal of plant parts

Pulled plants should not be left on site or composted as they may re-sprout and still produce seed. They should be disposed of in a manner that will ensure that their roots will dry out completely. If flowers are present, they should be burned or bagged and placed in a municipal landfill. Where this is not possible, any resulting seedlings will require monitoring and control.

Although landscape waste cannot generally be disposed of in landfills, Michigan law permits the disposal of invasive species plant parts. See the "Online resources" section for a link to the relevant legislation.



Online resources:

CDMS - herbicide labels

<http://www.cdms.net/LabelsMsds/LMDefault.aspx?t=v>

Fire Effects Information System, Canada thistle

<http://www.fs.fed.us/database/feis/plants/forb/cirarv/all.html>

Invasive.org

<http://www.invasive.org/>

Michigan Department of Agriculture and Rural Development—Pesticide Certification

www.michigan.gov/pestexam

Michigan Department of Environmental Quality—Aquatic Nuisance Control

www.michigan.gov/deqinlandlakes

http://www.michigan.gov/deq/0,4561,7-135-3313_3681_3710---,00.html

Michigan Department of Natural Resources—Local DNR Fire Manager contact list

http://www.michigan.gov/dnr/0,4570,7-153-30301_30505_44539-159248--,00.html

Michigan Invasive Species Coalition:

<http://www.michiganinvasives.org/>

Michigan's Invasive Species Legislation

Natural Resources and Environmental Protection Act 451 of 1994, Section 324.4130

<http://legislature.mi.gov/doc.aspx?mcl-324-41301>

Michigan Legislation—landscape waste, disposal of invasive species plant parts

Natural Resources and Environmental Protection Act 451 of 1994, Section 324.11521, 2 (d)

<http://legislature.mi.gov/doc.aspx?mcl-324-11521>

Midwest Invasive Species Information System:

<https://www.misin.msu.edu/>

MIPN Invasive Species Control Database

<https://mipncontroldatabase.wisc.edu/>

MISIN Mapping Phone Apps:

<http://www.misin.msu.edu/apps/>

The Nature Conservancy's Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas

<http://www.invasive.org/gist/handbook.html>

University of Michigan Herbarium - Michigan Flora Online

<http://michiganflora.net/>



Quick reference—Canada thistle

This chart has been provided as a convenience to summarize the pros and cons of each herbicide and to present details on adjuvants, concentrations, etc., that do not fit into the discussion in the preceding sections. Although every attempt has been made to ensure accuracy, the product labels for the listed herbicides are the ultimate authority for their usage. Where there are conflicts, always follow the label directions. Techniques are listed in order of general preference by MDNR Wildlife Division staff but not all are suitable for wetlands or sensitive sites. Site conditions vary—choose a method that is best suited to conditions on the site being treated.

Anyone using herbicides in the course of their employment is required to be a certified pesticide applicator. Treatment in wetlands or over open water requires a permit from the Michigan Department of Environmental Quality.

These chemicals are available in a variety of formulations and concentrations. In some cases, concentration is listed below as a percentage of the active ingredient (AI) to facilitate use of different products. Where this is not possible, the label recommendation for the example product is used. Always follow all directions on the product/brand label including mixing instructions, timing, rate, leaf coverage and the use of personal protective equipment.

	Herbicide	% A.I.	Adjuvant	Timing	Pros	Cons
Foliar Spray	Glyphosate (e.g., Roundup®, Rodeo®, Accord®)	1-3%	Some products already contain a surfactant - if not, add one (e.g., Cygnet Plus®, NuFilm IR®).	Apply to rosettes in fall or spring or when plants are bolting.	Some products approved for use in wetlands.	Non-selective! Use only when few or no natives are present.
Foliar Spray	Aminopyralid (e.g., Milestone®)	7 fl oz/ acre 14 fl oz/ acre for spot treatment (no more than 50% of an acre may be treated in one year).	Use a non-ionic surfactant (e.g., Cygnet Plus®).	Apply in spring up to flowering stage. Can also be applied in fall before frost.	Effective on Canada thistle. Broadleaf-specific—will not kill established native grasses. Can be applied up to water's edge. Provides some residual control of germinated seedlings.	Expensive. Persists in soil for up to one year--this can be good or bad. Legumes particularly vulnerable. Restrictions on grazing and haying. Manure management required—no composting. Overspray or drift will harm non-target broadleaf plants.
Foliar Spray	Clopyralid (i.e., Transline®)	1/3-1 1/3 pints/acre. Broadcast: 10-16 fl oz/A (0.25 – 0.4 lb a.e./A) Spot: 0.2 – 0.4% (0.0005 – 0.01 lb a.e./gal)	Use a non-ionic surfactant (e.g., Cygnet Plus®).	Apply to dry, actively growing weeds; may be most effective at bud stage, but before flowering.	Effective on Canada thistle. Broad-leaf specific – will not harm well-established grasses.	Persists in soil for months—this can be good or bad. Not for use in porous soils or areas with high water table as it can contaminate ground water. Manure management required—no composting. Overspray or drift will harm non-target broadleaf plants. Buffer strip between treatment area and surface water recommended.

Note: Hand-pull survivors and seedlings as follow-up or in small populations; wear heavy gloves.

