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# Methods and Practices for Control of Canada Thistle

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*This Transportation Research Synthesis provides brief summaries of recent research on a topic of current interest. Online links are active at the time of publishing, but are not updated after that time.*

## INTRODUCTION

Recognizing the challenges in controlling the weed, Canada thistle, the Minnesota Department of Transportation (Mn/DOT) and the Minnesota Local Road Research Board (LRRB) have supported research on the topic. This synthesis offers a brief summary of that work and provides additional information about other national and international research, Mn/DOT methods and practices, other state department of transportation practices nationwide, and research in progress.

Canada thistle, or *Cirsium arvense*, is also known as creeping thistle and Californian thistle. Canada thistle threatens natural communities by competing with and displacing native vegetation, as well as decreasing the diversity of species and changing the habitat. Invasive in parts of the country with prairies and other grasslands, such as Minnesota, Canada thistle spreads primarily by vegetative means and secondarily by seed.

## MINNESOTA STUDIES

Minnesota has supported a number of studies related to control of Canada thistle. One 1968 study, Canada Thistle Control on Roadsides, assessed the application in the field of picloram (Tordon). More recent studies, funded by Mn/DOT and the LRRB, include the following.

- *Controlling Leafy Spurge and Canada Thistle by Competitive Species*, David D. Biesboer, Bettina Darveaux, and Willard Koukkari, 1994

[www.lrrb.org/pdf/199432.pdf](http://www.lrrb.org/pdf/199432.pdf)

This study assessed the use of perennial native grasses to control leafy spurge and Canada thistle and evaluated the effects of herbicides that were applied during the fall to leafy spurge crown buds. Grass treatments that included native prairie grass little bluestem established well and reduced the leafy spurge cover. The careful selection of grass species proved important to the success of establishing enough grass for the native grass species to take hold. All application of the herbicide picloram at .5 and one pound ai/acre effectively controlled leafy spurge.



• *Biological Control of Canada Thistle in Wetland Prairie Restoration*, Kari Eichstaedt, Donald Wyse, and Gregg Johnson, 2007

[www.lrrb.org/pdf/200738.pdf](http://www.lrrb.org/pdf/200738.pdf)

This research involved evaluating *Pseudomonas syringae* pv *tagetis* (Pst) as a natural biological control agent for Canada thistle. This experiment provides evidence that grass and litter are important components of the landscape in supporting the natural Pst infection of Canada thistle. Perennial grass competition offers the potential to manage Canada thistle in roadside rights-of-way and wetland restoration sites.

• *Management Practices for Weed Control in Roadway Rights-of-Way*, C. Arika, D. Wyse, J. Nieber, and R. Moon, 2007

[www.lrrb.org/pdf/200742.pdf](http://www.lrrb.org/pdf/200742.pdf)

In this study, researchers tested a survey design with one-quarter mile segments and ecozone stratification in Mn/DOT District 4 to help quantify infestations of Canada thistle. Results showed that the district's design of three-mile segments and the study's quarter-mile segments yielded equivalent estimates of mean acres per roadway mile of Canada thistle, leafy spurge, and poison ivy. Precision improved with the one-quarter mile plan. Weed abundances also varied substantially among ecozones. Computer-based mapping and resampling also indicated improved precision and efficiency with segment lengths of 125 feet or less. The report concluded that shorter segments would reduce inspection costs, increase sample size, and improve precision. Surveys also found a very high incidence of Canada thistle – 20 times more prevalent than any other weed, according to a Technical Summary on the project.

• *Production and Wind Dispersal of Canada Thistle*, R.L. Becker, M.J. Haar, B.D. Kindaid, L.D. Klossner, and F. Forcella, 2008

[www.lrrb.org/PDF/200839.pdf](http://www.lrrb.org/PDF/200839.pdf)

This study looked at the role that wind dispersal and seed production play in the spread and persistence of Canada thistle infestations. Researchers conducted two experiments – one that characterized the extent

of Canada thistle wind dispersal, and the second, the quantity and viability of seeds produced by Canada thistle stands. The research revealed that wind dispersal is not as significant a factor in the movement of Canada thistle seeds as was commonly thought, as many viable seeds fell to the ground nearby. Researchers recommended that Canada thistle management strategies focus less on wind dispersal and more on controlling the stand of thistle and the seed bank close to the parent plants.

## **NATIONAL AND INTERNATIONAL RESEARCH**

Several research studies address control of weeds, such as Canada thistle, along roadsides.

In *Indiana*, a series of research studies looked at new treatment combinations.

• “A 10-Year Evaluation of Plant Growth Regulator Carryover in Roadside Test Pilots in Indiana,” James Morre, *Journal of Plant Growth Regulation*, 1993

In this trial, researchers applied three primary growth regulators/herbicides – mefluidide (primary growth retardant), chlorsulfuron (synergistic additive) and sulfometuron – alone and in combination with and without surfactant or 2,4-dichlorophenoxyacetic acid to track their impact on vegetation. The findings showed that mefluidide alone or in combination with the sulfonyleurea herbicides, chlorsulfuron or sulfometuron, did not result in permanent damage to turf or detrimental carryover of materials.

• *New Treatment Combinations for Control of Brush and Vegetation Management Along Indiana Roadsides*, James Morre, December 2000

In this project, researchers developed and implemented new treatment mixtures for control of problem bush, trees and woody species, and herbicide-resistant weeds along Indiana roadsides. These treatments included mixtures of triclopyr, clopyralid, ammonium nitrate, and a new series of thiol reagent (TR) additives for brush control and for possible use to control Canada thistle and other herbicide-resistant roadside weeds.

“The new additive enhances the effectiveness of roadside herbicides for control of difficult-to-kill, noxious, or unsightly weeds,” according to the report. “The additive is a safe and biodegradable natural substance that is inexpensive and allows for less frequent spraying and reduces overall herbicide requirements by 50 percent.”

In *Pennsylvania*, the Penn State Vegetation Management Project, which began in 1985, assists the Pennsylvania Department of Transportation in the continued development of its roadside vegetation management program.

- *Managing Canada thistle*, Conservation Reserve Enhancement Program Technical Assistance Series

<http://vm.cas.psu.edu/pubs.html>

The publication describes Canada thistle and its growth patterns. It recommends multiple treatments for Canada thistle control, emphasizing the importance of injuring and exhausting its root system.

The *Nature Conservancy* compiled a report on Canada thistle that provides background on its growth, spread, and control.

- *Element Stewardship Abstract for Cirsium arvense*, The Nature Conservancy

This summary discusses the characteristics, habitat, reproduction, germination, and spread of Canada thistle, as well as information about biological control.

The *U.S. Department of Agriculture* shares information about Canada thistle and other weeds through its National Invasive Species Information Center

- Specific profiles: Canada thistle

[www.invasivespeciesinfo.gov/plants/canthistle.shtml](http://www.invasivespeciesinfo.gov/plants/canthistle.shtml)

This web site lists resources from the federal government, state governments, and universities, as well as from international sources.

In *Ontario, Canada*, the Ministry of Transportation investigated methods to establish tall grass prairie and wildflower planting along roadsides.

- *Wildflower and Prairie Seeding Recommendations for Ontario Roadsides*, Nancy Cain, Ministry of Transportation, 1997

Research showed the importance of controlling existing vegetation before planting to establishing wildflower or prairie communities on vegetated sites. The report offers recommendations for wildflower and prairie seeding on highway rights of way. Keys to establishing seed mixtures include a well-prepared seed bed, adequate seed/soil contact, and firming of the seed bed after seeding.

In *Colorado*, Colorado State Parks published a weed profile of Canada thistle that highlights best management practices and points to the effectiveness of herbicide application in the fall.

- *Best Management Practices*, Canada Thistle Weed Profile, April 1, 2005

[http://parks.state.co.us/NR/rdonlyres/A1DECFA8-3E90-4285-8FEF-5EFD858EFE08/0/Canada Thistle.pdf](http://parks.state.co.us/NR/rdonlyres/A1DECFA8-3E90-4285-8FEF-5EFD858EFE08/0/Canada%20Thistle.pdf)

The profile describes the identification of Canada thistle, its impacts, habitat and distribution, biology and ecology, and control. According to the profile, “Currently there is no single biological control agent that effectively controls Canada thistle.” Mowing offers a solution if repeated at about one-month intervals throughout the growing season; if frequent mowing is not possible, combining mowing with herbicides further enhances control.

It also notes that chemical control of Canada thistle should occur in the spring or fall, depending on local environmental conditions. “In general, fall treatments are more effective as herbicide absorption is enhanced in the late summer and fall when shoot to root translocation is the greatest.” It suggests that translocation of the herbicide depends on moist soil conditions, so if fall is dry in an area, then spring application may be better. In addition, it provides details about application rates.

Another research study also supports the application of herbicide control in the fall.

- “Using the Rosette Technique for Canada Thistle Control in Row Crops,” Brett R. Miller and Rodney G. Lym, *Weed Technology*, Vol. 12, No. 4, October-December 1998, pp. 699-706

[www.jstor.org/stable/3989090](http://www.jstor.org/stable/3989090)

The Rosette technique involves the use of tillage and fall-applied herbicides to control Canada Thistle in row crops: “The rosette technique is an equally effective Canada thistle control method as in-crop herbicide followed by fall-applied herbicide treatments.”

A study by *Iowa State University* discusses the importance of an integrated program in controlling Canada thistle.

- “Canada Thistle Management,” by Bob Hartzler, *Weed Science*, 2002

[www.weeds.iastate.edu/mgmt/2002/canada\\_thistle.htm](http://www.weeds.iastate.edu/mgmt/2002/canada_thistle.htm)

“In summary, Canada thistle control is best achieved through an integrated program. Since no single treatment can subdue an established infestation, repeated measures are needed for long-term control.”

The *government of Saskatchewan* has developed information about Canada thistle that provides an overview of its biology, life cycle, and cultural and chemical controls. It also supports an integrated approach.

- “*Canada Thistle and its Control*,” Government of Saskatchewan

[www.agriculture.gov.sk.ca/Canada\\_Thistle\\_Control](http://www.agriculture.gov.sk.ca/Canada_Thistle_Control)

“Canada thistle is a difficult weed to control because of its extensive perennial root system. Because Canada thistle causes yield losses at relatively low numbers, keeping it in check can provide substantial economic benefit. A long-term plan that combines the above tools and techniques over a number of years is needed to bring the weed under control.”

## MINNESOTA DEPARTMENT OF TRANSPORTATION PRACTICES

Minnesota’s Noxious Weed Law (Minnesota Statutes 18.75-18.88) requires agencies to control prohibited noxious weeds on the roadside or right-of-way. Canada thistle is considered a prohibited noxious weed.

Mn/DOT provides several resources that outline department practices for mowing and weed control, including control of Canada thistle.

- *Mn/DOT Maintenance Manual*

[www.dot.state.mn.us/maint/files/maint\\_manual/ch5.pdf](http://www.dot.state.mn.us/maint/files/maint_manual/ch5.pdf)

The *Mn/DOT Maintenance Manual* outlines practices for mowing, as well as guidelines for weed control on roadsides. Mn/DOT weed control methods fall into four types: physical, cultural, biological, and chemical. Mowing is used as one physical method to control weeds, such as Canada thistle, but the manual says that a prevention program may require numerous mowings. Repeated mowing as a sole practice for weed control is an expensive alternative; in addition Minnesota statute 160.232 restricts mowing of an entire right-of-way from July 31 to August 31; mowing of the entire right-of-way may occur for safety reasons from August 31 to July 31. The manual also describes the application of herbicides, which are used because of their effectiveness, cost, and ease of application. Mn/DOT has explored biological control with Canada thistle, but it has not proven effective. Mn/DOT continues to coordinate with other agencies to identify more biocontrol agents for noxious weed control.

- *Best Practices Handbook for Roadside Vegetation Management*

[www.lrrb.org/pdf/200820.pdf](http://www.lrrb.org/pdf/200820.pdf)

The *Best Practices Handbook for Roadside Vegetation Management* includes information on developing a mowing policy and improved procedures, and control of prohibited and restricted noxious weeds, such as Canada thistle. The handbook calls for an integrated approach for successful roadside vegetation management.

- *Partial List of Pest Situations and Possible Pesticide and Other Control Methods for Mn/DOT Roadside Vegetation Management on Rights of Way*, by Paul Walvatne

This report provides a list of potential control products for specific situations or weeds, as well as links to Mn/DOT Herbicide Policy & Guidelines.

## STATE DEPARTMENT OF TRANSPORTATION PRACTICES

Many states have developed methods to control noxious weeds, including Canada thistle. The following sources include information about those practices.

- “An Innovative Way to Control Roadside Weeds,” *Colorado LTAP*, 2004

[www.ltap.colorado.edu/newsletter/Newsletter\\_SpecialEdition04.pdf](http://www.ltap.colorado.edu/newsletter/Newsletter_SpecialEdition04.pdf)

One innovative and economical method of weed control involves the hiring of goats and sheep to graze on weeds. According to Wyoming Department of Transportation estimates, controlling weeds with sheep costs between \$100 and \$300 less per acre than traditional methods. The article also includes a link to the Noxious Weed Management Program of the Colorado Department of Agriculture.

- *Noxious Weed Management Guidelines*, New Mexico DOT Environmental Section, 2000

[www.nmshtd.state.nm.us/main.asp?secid=15313](http://www.nmshtd.state.nm.us/main.asp?secid=15313)

These guidelines include herbicide spraying, hand pulling, and burning for Class A weeds, such as Canada thistle.

- *Noxious Weed Control Plan for U.S. 95*, Idaho, 2006

The plan for weed control on the construction project for U.S. 95 includes seeding, weed surveys, and herbicide control.

- *Noxious Weed Management Plan, U.S. 34*, Colorado, April 2007

[www.dot.state.co.us/us34ea/PDFs/EA/Appendix-E.pdf](http://www.dot.state.co.us/us34ea/PDFs/EA/Appendix-E.pdf)

“The key to successful control is the development of a sound management plan. Canada thistle is best controlled by a combination of monthly mowing and herbicides (clopyralid, 2,4-D, or a combination of these).”

- “Herbicides Help Illinois DOT Control Roadside Weeds,” *American City and County*, 1998

The Illinois Department of Transportation found herbicides more effective solution than mowing for weed and brush control. Spraying herbicides costs about \$15 per acre, while mowing costs about \$30 per acre.

- *Control of Invasive Species: A Synthesis of Highway Practice*, NCHRP Synthesis 363, Transportation Research Board, 2006

This synthesis includes information about weed control from 40 state transportation agencies and the U.S. Forest Service. It describes invasive species, provides context to federal, state, and local efforts, and identifies roadside controls and methods.

## RESEARCH IN PROGRESS

The following research project will advance knowledge about controlling Canada thistle.

- *New Treatment Combinations for Vegetation Management Along Indiana Roadside*, Indiana Department of Transportation

<http://rip.trb.org/browse/dproject.asp?n-5145>

Researchers are developing and implementing new treatment mixtures for control of problem brush, trees, and weeds along Indiana roadsides, including herbicide-resistant species. Researchers are looking at additives that at very low rates of application help enhance the effectiveness of certain phenoxy-type herbicide and brush control agents. The additives show promise for control of herbicide-resistant broadleaf weeds.

# Summary

Identified as a noxious weed, Canada thistle has been a topic of research and implementation efforts by Minnesota and other departments of transportation for many years. In Minnesota, a recent survey in one area of Northern Minnesota found the incidence of Canada thistle to be significantly higher than any other weed.

Minnesota studies show the effectiveness of using herbicides and supporting the establishment of native prairie species as a competitor to Canada thistle. Most recent research looked at quantifying and tracking Canada thistle in segments, with smaller segments improving precision and helping reduce inspection costs.

Research studies have helped identify herbicide treatments for control of Canada thistle, as well as demonstrating the need for a mix of control strategies. Several studies cite the importance of an integrated approach and a long-term plan for control. Ongoing research continues to explore new treatment mixtures, as well as work to refine control management practices. One recent Minnesota research proposal calls for a systems approach for reducing Canada study, one that would consider how the various methods of controlling Canada thistle might work together for a more effective solution.

“Our current practices of reduced mowing with our cool-season dominated introduced grasses seems to ensure a good supply of Canada thistle and a very efficient spread of seeds,” says Paul Walvatne, Mn/DOT forestry unit supervisor. “There is no silver bullet when it comes to Canada thistle. The research proposal looks at building a system of control methods, which has not been addressed in research efforts before. Canada thistle is a formidable foe, but finding the right combination of techniques may lead to more efficient and effective control.”