



RESEARCH SERVICES SECTION

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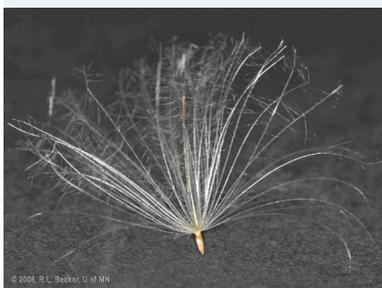
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PROJECT COST:

\$88,000



Pappi are featherlike tufts that facilitate wind dispersal of Canada thistle seeds.

Production and Wind Dispersal of Canada Thistle Seeds

What Was the Need?

Canada thistle is the most prevalent noxious weed on Minnesota roadside rights of way, and Mn/DOT puts a high priority on controlling its infestations. A non-native and invasive species that can outcompete native plants, Canada thistle is a costly threat to farmlands, natural ecosystems and roadway safety.

Canada thistle is very difficult to manage, in part because of its propagation by wind-borne seeds. Seeds are facilitated in wind dispersal by loosely attached, featherlike tufts called pappi. Public and private landowners are required by law to control Canada thistle and often assume that windblown seeds are an important means of dispersal and invasion of new sites. It was unclear to what extent this assumption was correct, and whether optimal management practices were in place.

Canada thistle seeds separate easily from pappi, so they may not travel as far as generally thought. Further, seed production by Canada thistle is highly variable: Many flowers do not produce seeds, and seed viability varies greatly. Finally, seeds take flight at a time of year when herbicide use, mowing or hand rouging are minimally effective in controlling the perennial root system. Management practices are expensive and can damage desirable native ecosystems. For these reasons, the land managers' goal is to obtain the best control of the thistle stand, not merely its seed flight. Controlling Canada thistle's extensive underground root system is more economically and effectively achieved in the late spring before flowers set seed or in the fall after seeds are produced.

What Was Our Goal?

The objective of this study was to better understand the role that wind dispersal and seed production play in the spread and persistence of Canada thistle infestations, ensure that Mn/DOT enforcement guidelines for long-term thistle management are cost-effective and address actual rather than perceived problems.

What Did We Do?

Researchers conducted two experiments: The first characterized the extent of Canada thistle wind dispersal, and the second, the quantity and viability of seeds produced by Canada thistle stands.

In the first experiment, researchers used traps constructed of adhesive-coated wire mesh to evaluate the quantity, viability and dispersal distance of windblown seeds and pappi at 12 Minnesota sites during 2006 and 2007. Researchers recorded the number of pappi released and whether or not a seed was attached, and used laboratory tests to evaluate seed viability. They then counted the number of flower clusters in Canada thistle stands and estimated the percentage contribution to dispersal. Finally, researchers mapped seed and pappi deposited at various distances from thistle stands to evaluate the effect of wind on the direction and distance of seed dispersal. In the second experiment, researchers monitored the production and viability of seed in Canada thistle populations at eight Minnesota sites to better characterize typical seed production potential.

What Did We Learn?

Wind dispersal is not as significant a factor in the movement of Canada thistle seeds as was commonly thought. Most viable seeds fall to the ground nearby without pappi attached. Further, many seeds produced by Canada thistle stands are either nonviable or of questionable viability.

“There was not a lot of long-distance wind dispersal of seed. Land managers are better off focusing on controlling the seedbanks of Canada thistle patches themselves than on wind-based dispersal.”

–Donald Wyse,
Professor, University of
Minnesota Department
of Agronomy and Plant
Genetics

“Adapting management practices to the realities of Canada thistle dispersal could make controlling this weed considerably less costly and more environmentally friendly.”

–Tina Markeson,
Mn/DOT Senior Natural
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Many seeds produced by Canada thistle stands are empty (left), without the embryo and starch accumulation of a regular seed, and so cannot germinate. Full seeds (right) are shown for comparison.

Wind strength had relatively little influence on dispersal. Even in the rare case of sustained strong winds, pappi were violently released by thistle as heavy, entangled clusters, with seeds either not attached or trapped inside. Researchers concluded that only low numbers of seeds are propagated long distances by strong winds, and they estimate these have a slim chance of germinating and establishing new colonies.

On the other hand, Canada thistle stands generate a large number of seeds in close proximity, and these seedbanks are critical to the persistence of invasive stands.

What's Next?

Researchers recommended that Canada thistle management strategies focus less on wind dispersal and more on controlling the stand of thistle and the seedbank close to the parent plants. Education programs are needed to inform the public and land managers that the Canada thistle seedbank is really building close to home, and about the importance and proper timing of management decisions, such as determining when mowing and herbicide applications are most effective in controlling the thistle root system, thereby eliminating the controversy over seed flight altogether.

To refine our understanding of wind dispersal of Canada thistle and other wind-dispersed invasive plants, further study is needed about other factors influencing seed productivity and wind dispersal, including wind speed, turbulence and settling velocity, and the effects of the local environment on seed production and dispersal.