

## Spotted knapweed (*Centaurea biebersteinnii*)

University of Wisconsin Weed-Factsheet

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### INTRODUCTION

Spotted knapweed (*Centaurea biebersteinnii*; formerly *Centaurea stoebe* L. ssp. *micranthos*) is a tap-rooted herbaceous perennial plant that spreads by seed. Spotted knapweed tolerates a wide range of temperature and moisture conditions, and is well adapted to open-forest, pastures, and CRP land in Wisconsin. Disturbed sites including transportation corridors, gravel pits, campgrounds, trails, stream and river corridors, and industrial areas are highly susceptible to invasion. Once established on disturbed sites the weed readily moves into adjoining lands. The plant threatens long-term productivity of grazing lands and natural areas by reducing biodiversity and increasing soil erosion. The plant begins growth in spring from basal leaves which form rosettes on a central crown. In early summer the plant will begin to bolt (send up a flower stalk) where the flowers will develop. Flowers occur from mid-summer through early September.



Spotted knapweed is native to Eastern Europe, although it now occurs in western and central Europe. It was first reported in North America in 1893 (Groh 1944), and was probably introduced as a contaminant in alfalfa seed and/or ship ballast (Roché and Talbot 1986). Spotted knapweed currently infests about 6.9 million acres in the U.S. (Duncan 2005) and is reported in all U.S. states except Alaska, Texas, Oklahoma, Mississippi, and Georgia (USDA NRCS 2006). It appears to be rapidly spreading throughout the state, especially in areas with lighter (sandier) soils. Early detection and control is critical to management of spotted knapweed since it spreads easily by water, animals, humans, and vehicles.

### IDENTIFICATION

Spotted knapweed is herbaceous broadleaf that grows 8 inches to 4 feet tall and can live at least 9 years (Boggs and Story 1987). Basal rosette leaves are deeply divided into lobes on both sides of the center vein. Flowering stems are slender, many-branched and have a single flower at the tip of each branch. Flower color is usually pinkish-purple, but can also be light purple or white. Each flower head has bracts located under flower petals that are marked with fine vertical



streaks and tipped with a dark comb-like fringe (Whitson et al. 1991). These bracts give a “spotted” appearance to the flower head.

## REPRODUCTION AND SPREAD

Spotted knapweed spreads by seed, and produces about 1000 seeds or more per plant. Seeds remain viable in soil for more than eight years (Davis et al. 1993). Spotted knapweed spreads by expansion of existing stands and long-distance movement. Seeds are dispersed by wildlife, livestock, humans, and vehicles, as contaminants in crop seed and hay, and by water flowing in streams, rivers and irrigation canals. The annual rate of spread of spotted knapweed can vary, but averages 15% in the western United States (Duncan and Jachetta 2005).

## MANAGEMENT

Spotted knapweed can be controlled with various management techniques. Preventing movement



of knapweed seeds to non-infested sites is a critical management consideration. People and their motorized vehicles are a major cause of knapweed spread. It is imperative to wash the undercarriage of vehicles that have been in weed-infested areas. Do not walk, drive, or trail livestock through knapweed-infested sites. Only certified weed-free seed, hay and topsoil should be purchased. Livestock should not be grazed in knapweed infested sites during flowering and seed dispersal. Livestock grazing in infested pastures should be held for seven days prior to moving to non-infested pastures. Once knapweed is established, infestations should be controlled as soon as possible to prevent seed production and spread. High risk sites for invasion include transportation corridors, riparian areas, campgrounds, trailheads and other disturbed sites. These areas should be monitored annually for newly invading plants.

### *Physical/Mechanical/Cultural*

Plant communities that maintain competitive desirable vegetation can slow establishment and spread of spotted knapweed. In areas where desirable species are absent, long-term control of spotted knapweed is unlikely (Sheley et al. 1999). Establishing competitive desirable plants is essential for successfully managing spotted knapweed.

Spotted knapweed is a tap-rooted plant that can be controlled with cultivation to a depth of 7 inches, or hand removal. Persistent pulling or digging can control spotted knapweed (Duncan et al. 2002) if the upper 3 inches of the crown portion of the plant are removed before the plant produces seed. Plants that are pulled after flowering begins should be carefully disposed of to destroy viable seed. While pulling or digging is effective on single plants or relatively small infestations, it is not economically or physically feasible on large, well-established knapweed infestations. Disturbance caused by cultivation or hand-removal increases susceptibility of the site to reinvasion by knapweed or other weeds. Disturbed sites should be seeded to desirable vegetation to stop reinvasion.

Mowing will not control spotted knapweed; however, it can be used to reduce seed production. The optimum time to mow spotted knapweed to reduce seed production is at the late

bud growth stage. Mowing in combination with an herbicide treatment may improve control over the herbicide treatment alone (Duncan 2002).

A single, low-intensity fire does not control knapweed (Rice and Harrington 2005), and may increase knapweed cover and density (Dewey 2000). Under wildfire situations, spotted knapweed has been observed to increase probably as a result of increased open areas which promote establishment and spread of the knapweeds. Fire followed by herbicide treatments may increase effectiveness of herbicide treatments on knapweed (Sheley and Roche 1982, Dewey 2000).

Low to moderate use of spotted knapweed by cattle, sheep, goats and some wildlife has been reported (Duncan et al. 2002). Controlled, repeated grazing of spotted knapweed by sheep can reduce the number of one- and two-year-old spotted knapweed plants within an infestation (Olsen et al. 1997). Grazing should be timed so that associated grasses are dormant to limit impact on desirable species.

### *Biological Control*

Thirteen Eurasian natural enemies (all insects) have been introduced into the United States for biological control of spotted and diffuse knapweed (Duncan et al. 2002). Although most of the insects attack both knapweeds, those most effective on spotted knapweed are described below.



- Two flower head flies (*Urophora affinis* and *U. quadrifasciata*). The larvae of these flies induce galls in spotted flower heads which reduce seed production. Seed reductions in excess of 50 percent are occurring in areas where the two fly species coexist.
- A flower head moth (*Metzneria paucipunctella*). The larvae feed on the florets and seeds of spotted knapweed. Each larva destroys about eight seeds per flower head.
- A root moth (*Agapeta zoegana*) and a root weevil (*Cyphocleonus achates*). Larvae of the moth girdle knapweed roots, while the weevil larvae feed in the center of the roots.
- A root beetle (*Sphenoptera jugoslavica*). The larvae feed in the center of the root. The beetle primarily attacks the roots of diffuse knapweed, but will also attack spotted knapweed.
- Two flower head weevils (*Larinus minutus* and *L. obtusus*). The larvae of both weevils feed on knapweed seeds, and the adults feed on knapweed leaves.

### *Herbicides*

Several herbicides that are selective for broadleaf plants can effectively control spotted knapweed. Herbicides containing clopyralid, or aminopyralid are most effective. Dicamba and 2,4-D will provide inconsistent control and must be applied annually for at least 2 years to control mature and seedling plants. Although glyphosate (many trade names) will kill spotted knapweed, it is a non-selective herbicide that will kill both grasses and broadleaf plants. Time of herbicide application depends on the herbicide selected and growing conditions. In general, spotted knapweed can be controlled from spring to early summer before the weed flowers, and during fall if there is adequate moisture. ***It is important to read the herbicide label BEFORE making any application, as different herbicides will have different requirements and restrictions.***

Table 1. Herbicide options for spotted knapweed management. Herbicides included in this table are **selective for broadleaf plants and will not harm grasses** when applied at recommended rates.

Herbicide	Active Ingredient	Rate of Herbicide (amount/acre)	Timing of Application	Comments
Many products	2,4-D ester or amine	Depends on formulation (2 lb a.i.)	Rosette to late-bolt	<ul style="list-style-type: none"> <li>• No soil residual to control seedlings</li> <li>• Apply annually for at least 2 years</li> </ul>
Milestone	Aminopyralid	5 to 7 fl oz	Anytime plants are actively growing	<ul style="list-style-type: none"> <li>• Has soil residual activity</li> <li>• Can apply up to waters edge</li> </ul>
Curtail	Clopyralid + 2,4-D	2 to 3 quarts	Rosette to bud	<ul style="list-style-type: none"> <li>• Has soil residual activity</li> <li>• Do not apply to shallow groundwater areas</li> </ul>
Redeem	Clopyralid + triclopyr	2 to 3 pints	Rosette to bud	<ul style="list-style-type: none"> <li>• Has soil residual activity</li> <li>• Do not apply to shallow groundwater areas</li> </ul>
Transline	Clopyralid	2/3 to 1 pint	Rosette to bud	<ul style="list-style-type: none"> <li>• Has soil residual activity</li> <li>• Do not apply to shallow groundwater areas</li> </ul>
Many products	Dicamba	Depends on formulation (0.5 to 1 lb. a.i.)	Rosette to bud	<ul style="list-style-type: none"> <li>• Has soil residual activity.</li> <li>• Addition of 2,4-D to dicamba will increase control</li> </ul>

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Web Sites:

- <http://tncweeds.ucdavis.edu/esadocs/documnts/centmac.html>
- <http://www.mtweed.org/Identification/Knapweed/knapweed.html>
- [http://www.fs.fed.us/database/feis/plants/forb/cenmac/fire\\_effects.html](http://www.fs.fed.us/database/feis/plants/forb/cenmac/fire_effects.html)