University of Nebraska Cooperative Extension EC02-172-S

Noxious Weeds of Nebraska

Plumeless Thistle

Kara L. Hilgenfeld, Former Research Assistant
Alex R. Martin, Extension Weed Specialist

Biology

Identification

Distribution

Control

Plumeless Thistle

Plumeless thistle (*Carduus acanthoides* L.) is one of seven noxious weeds in Nebraska. An introduced invasive broadleaf weed native to Europe and Asia, plumeless thistle currently infests about 65,000 acres in Nebraska. Infestations of plumeless thistle may reduce productivity of pastures and rangeland, where infestations tend to be the largest. Plumeless thistle competes with and suppresses growth of desirable species. Heavy infestations prevent livestock from grazing the area and lighter infestations prevent livestock from eating plants growing near the thistle *(Figure 1)*. Estimates place the annual loss in Nebraska agricultural production due to plumeless thistle at $162,000. Although plumeless thistle is more limited in distribution than its close relative the musk thistle (*Carduus nutans* L.), the infestations require landowners and producers in Nebraska to spend thousands of dollars each year for control.

Figure 1. Dense infestations of plumeless thistle interfere with livestock grazing.

History

The native distribution of plumeless thistle covers Europe and Asia. It was first introduced to North America on the east coast. The earliest collection in North America was at Camden, New Jersey, in 1879. Plumeless thistle was first observed in other midwest states, including Iowa, South Dakota, Wyoming, Colorado, Idaho, Minnesota, and Wisconsin. In 1967, the Nebraska Legislature proclaimed plumeless thistle as a noxious weed, requiring all landowners in the state to control it.

Biology

Plumeless thistle, a member of the sunflower family, is primarily found in pastures, rangeland, and non-cropped areas in northeastern Nebraska. The plant can be a biennial, winter annual, or occasionally summer annual. Biennials take two seasons to complete their life cycle, with vegetative growth the first year and reproduction the second. Winter annuals complete their life cycle in one year, germinating in late summer or fall and completing flowering in spring or summer. Summer annuals germinate in the spring, flower, produce seed, and die the same year. Typically plumeless thistle acts as a biennial with seed germination in April. Plants grow vegetatively the first year, overwintering in the rosette stage. (A rosette is a circular cluster of leaves growing close to the ground.) In the second season of growth, plumeless thistle produces a flowering stalk and flowers from June to August (*See Life Cycle, Figure 11*).

Plumeless thistle only reproduces from seed. Approximately 50 to 80 seeds are produced per head. Although most seeds germinate in the following year, seed viability can remain high for more than 10 years in the soil. Germination potential of the seed varies from 75 to 95 percent.

Plumeless thistle is primarily a cross-pollinated species with limited self-pollination occurring. There are reports of hybridization between plumeless thistle and musk thistle. Studies of numerous hybrid populations suggest that plumeless thistle type intermediates are more common throughout the summer. Various species of wasps and bees have been observed pollinating the flowers of plumeless thistle. This is thought to contribute to the gene flow and hybridization between plumeless and musk thistles.

Plumeless thistle seeds are mainly dispersed by the wind and fall near the parent plant. The seeds are attached to a pappus, a white feathery attachment that aids wind dispersal. It has been observed that less than one percent of the seed is carried further than 330 feet.

The pappus often breaks off and blows away with the seed remaining attached to the flower head.

The non-native thistle does have some value in its Nebraska habitat. Plumeless thistle is an important plant for many butterfly and songbird species. Songbirds eat the thistle seeds, which may contribute to seed dispersal.

Plumeless thistle may accumulate poisonous levels of nitrates when drought stressed, as do many plants; however, this does not appear to pose a problem for livestock since livestock will generally not eat the plant due to spines on leaf margins.

Identification

The basal rosette of the plumeless thistle is well developed. The leaves of the rosette are narrowly oval or oblong *(Figure 2)* and deeply lobed, near the midrib *(Figure 3)*. The one to three points of each lobe end in a spine. The leaves of plumeless thistle are lobed to the midrib in contrast to the leaves of the musk thistle (*Figure 4*). The rosette leaves have fewer hairs than the stem leaves. The plumeless thistle is supported by a stout, fleshy taproot, which can penetrate the soil to a depth of several feet.

Plumeless thistle grows to a height of 1 to 5 feet, usually reaching 3 to 4 feet. The stem of plumeless thistle is erect, freely branching in the upper portion of the plant *(Figure 5)*. The leaves extend onto the stem, giving it a

Figure 2. Leaves on the plumeless thistle rosette are narrowly oval or oblong and deeply lobed to the midrib.

Figure 3. Plumeless thistle leaves are deeply lobed, almost to the midrib.

Figure 4. Leaves of musk thistle (left) and deeply lobed leaves of plumeless thistle (right).

Figure 5. Plumeless thistle plants branch freely in the upper portion of the plant.

winged or frilled appearance *(Figure 6)*. The stem can be densely hairy to nearly hairless. The leaves of the plumeless thistle are alternate, with one leaf at each node. The leaves are attached directly to the stem and extend downward from the point of attachment, giving them a curled look. The leaves are oval or oblong and 4 to 8 inches long. They are irregularly and deeply lobed with small spines along the margin. The segments of the lobes are one to four, pointed, with 1/32- to 1/4-inch long marginal spines. The surface of the leaves is covered with fine hairs, unlike the surface of the musk thistle.

The flower heads of the plumeless thistle are solitary or in clusters of two to five. The heads are 5/8 to 1 inch tall and 3/8 to 3/4 inch wide and smaller than the musk thistle flower *(Figure 6)*. There are several series of bracts or small leaf-like structures below the flower head, including spiny outer bracts (1/4 to 1/2 inch) and spineless inner bracts (3/4 inch). A distinguishing characteristic separating plumeless thistle from musk thistle is the presence of spiny wings on the flowering stalk (1/8 to 5/8 inch wide) up to the base of the plumeless thistle head *(Figure 7)*. The flower is purple, or rarely white or yellow, and is 1/2 to 3/4 inch long. The flower tube is 3/8 inch long and 1/32 inch wide. Anthers, the pollen-bearing portion of the flower, are 1/8 inch long, woolly, filaments.

The seed of plumeless thistle is straw-colored to light-brown. It is 1/8 inch long and slightly oblong to egg-shaped, appearing somewhat rectangular. At one end of the seed, there is a group of tiny barbed bristles, forming a ring *(Figure 8)*.

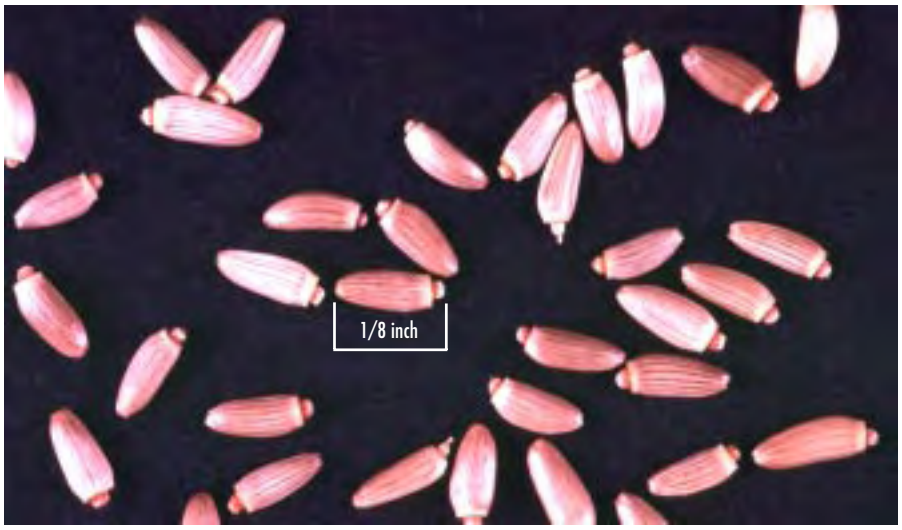


Figure 8. Seed is straw colored to light brown and 1/8 inch long.

Figure 7. Plumeless thistle [left] and musk thistle (nodding) [right]. Plumeless thistle stems are winged, and flowers are smaller than musk thistle.

Control Methods

The best strategies for controlling plumeless thistle use integrated weed management (IWM), a combination of two or more control methods. These can include cultural, mechanical, chemical, and biological control methods. The primary management goal should be to limit seed production. Pasture improvement programs consisting of cultivation, fertilization,

Figure 6. Plumeless thistle, unlike musk thistle, has spiny wings on the flower stalk up to the base of the thistle head.

and herbicide application can be effective control practices. Proper management of rangelands, including fertilization and proper grazing practices, are the most cost effective and profitable control methods. However, well-managed grasslands are not exempt from infestations. Continued monitoring and follow-up control measures are essential for maintaining plumeless thistle infestations at low levels.

Cultural

Cultural control involves maintaining vigorous and competitive desirable plants in the pasture. Plumeless thistle seedlings do not compete well with established forage grasses and developing desirable plant cover limits thistle establishment. Maintaining a good soil fertility program and preventing overgrazing are important in improving rangeland. Prescribed burning is also a good range management tool. Grazing sheep, goats, horses, or donkeys with cattle also can help control plants that cattle do not eat.

Maintaining a healthy pasture by using best management practices is the most cost effective and profitable way to prevent the invasion of plumeless thistles. Best management practices consist of fertilization, herbicide application, rotational and controlled grazing, and continuous monitoring.

Mechanical

It has been observed that plumeless thistle does not tolerate regular cultivation, digging, or cutting. Mowing is most effective at late bloom. Regrowth and production of viable seed usually occurs from plants mowed before the first terminal buds bloom *(Figure 9)*. At early growth stages, plumeless thistle must be cut at the soil surface to prevent the crown buds from resprouting.

Chemical

Several herbicide treatments are effective for plumeless thistle control *(Table I)*. Timeliness of herbicide application is the key to success and depends greatly on the plant life cycle. Plumeless thistle is most susceptible to growth regulator herbicides applied during active growth of the seedlings or rosettes prior to bolting (flower stalk formation). Treatment effectiveness decreases as growth stage advances past the rosette *(Figure 9)*. Treatments will likely need to continue over more than one year, due to the longevity of the seed in the soil. Herbicide application at late flower bud to early bloom, though less effective than earlier applications, can reduce seed production.

Fall herbicide applications offer several advantages over spring treatments. Because the thistles build up root reserves in the fall, herbicide applied in the fall moves readily from the foliage to the roots with the translocating sugars. Plumeless thistles growing in fall are either in the seedling or rosette growth stage and are therefore susceptible to herbicides. Growers generally have more time to treat in the fall than in spring. Also, with fall treatments there are fewer risks that herbicide drift will injure susceptible crops or trees like grapes, pecans, walnuts, soybeans or tomatoes as these plants have already matured. Fall application should be made after thistle germination has stopped, but while plants are actively growing and daytime high

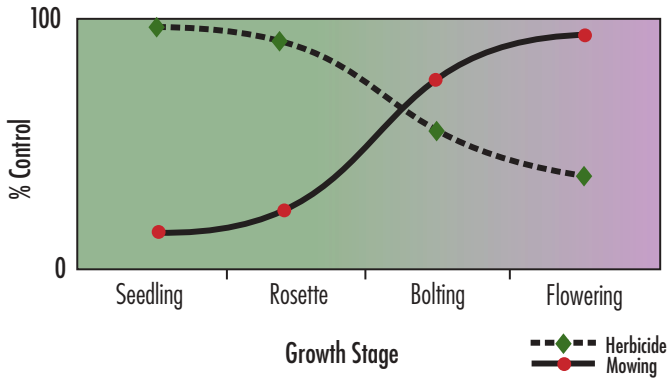


Figure 9. Response of plumeless thistle to herbicide application and mowing at different growth stages.

Distribution

Plumeless thistle infests 40 counties in Nebraska, 27 of which only have plants present occasionally. Plumeless thistle has economic importance, despite its limited distribution across Nebraska. The growing region covers eastern Nebraska and part of the western Panhandle of the state. Plumeless thistle is primarily found in northeastern Nebraska in pastures, rangelands, non-crop areas, and other open areas.

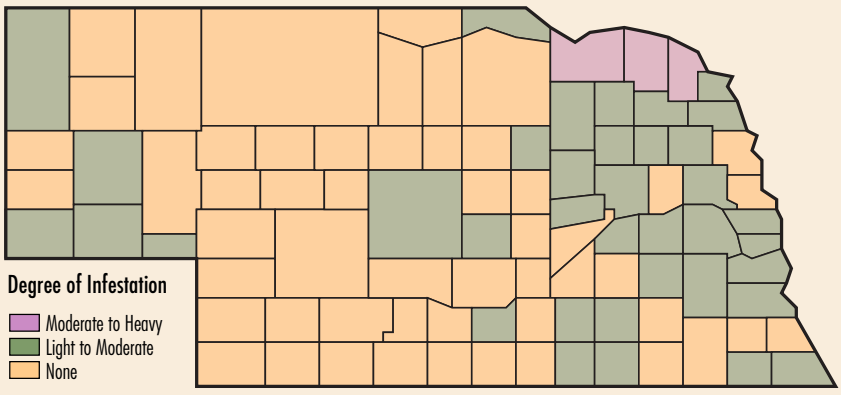


Figure 10. Distribution of plumeless thistle in Nebraska in 2001. Plumeless thistle is found less extensively than either Canada thistle or musk thistle.

temperatures are still above 50°F. It is important to scout fields in the fall, especially dry falls, prior to herbicide applications to determine if enough plants are present to justify treatment.

Biological

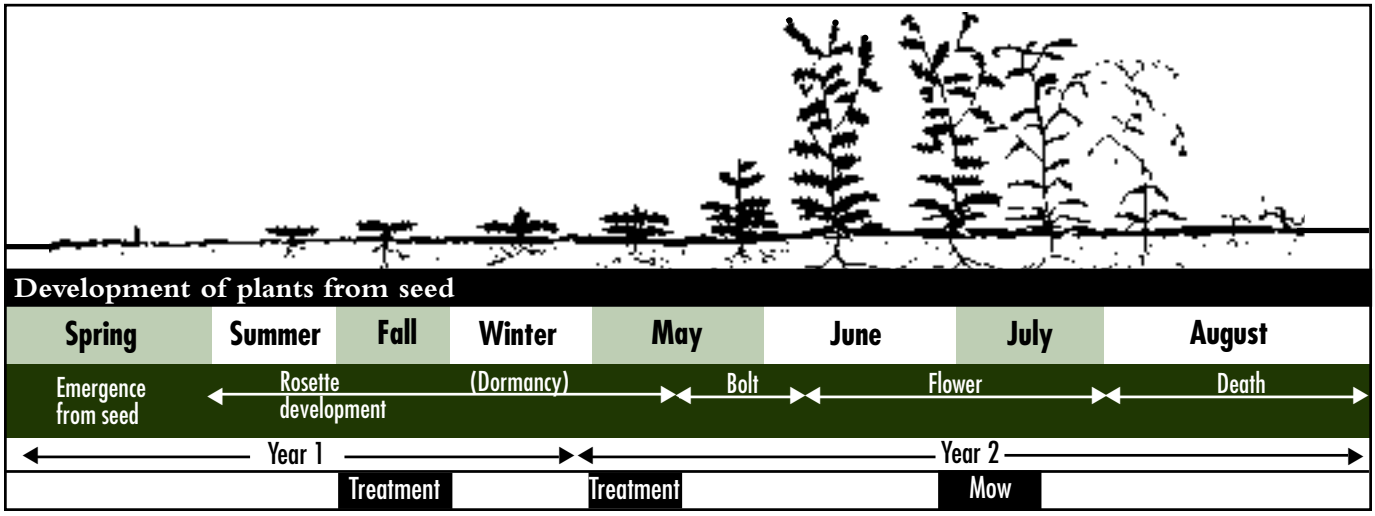
Several insects have been reported to feed on plumeless thistle and some of these insects have been evaluated for biological control. The *Rhinocyllus conicus* weevil, an insect of European origin, has been released in plumeless thistle in 23 states, including Nebraska. A rosette feeding beetle introduced from Europe, *Trichosirocalus horridus,* has also been used for biological control. Both of these exotic insects have been successfully established and contributed to significant reductions in plumeless thistle populations in Virginia.

Four fungi are capable of infecting musk and/or plumeless thistle, including parasitic rusts *Puccinia carduorum* and *P. galatica* and smuts *Ustilago cardui* and *U. violacea.* Of these, only *P. carduorum* has been introduced in North America.

Biological control agents should be considered as tools in plumeless thistle management; however, don't rely on these practices to completely control an infestation.

Note: Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by Cooperative Extension is implied.

Figure 11. Biennial life cycle of plumeless thistle in Nebraska.



References

Batra, S. W. T., J. R. Coulson, P. H. Dunn, and P. E. Boldt. 1981. Insects and fungi associated with *Carduus* thistles (Compositae). USDA Technical Bulletin. 1616 Washington, DC. 100 pp.

Burnside, O. C., C. R. Fenster, L. O. Evetts, and R. F. Mumm. 1981. Germination of exhumed weed seed in Nebraska, USA. Weed Science. 29:577-586.

Desrochers, A. M., J. F. Bain, and S. I. Warwick. 1988. The biology of Canadian weeds. 89. *Carduus nutans* L. and *Carduus acanthoides* L. Canadian Journal of Plant Science. 68:1053-1068.

Dunn, P. H. 1976. Distribution of *Carduus nutans, C. acanthoides, C. Pycnocephalus,* and *C. crispus* in the United States. Weed Science. 24:518-524.

Feldman, I., M. K. McCarty, and C. J. Scifres. 1968. Ecological and control studies of musk thistle. Weed Science. 16:1-4.

Furrer, J. D. and M. K. McCarty. 1966. Musk thistle—its appearance, spread and control. Nebraska Agriculture Experimental Station Research Bulletin. EC66-160.

Harris, P. 1984. *Carduus nutans* L., nodding thistle and *C. acanthoides* L., plumeless thistle (Compositae). Pages 115-116 *in* J. S. Kelleher and M. A. Hulme, eds. Biological control programs against insects and weeds in Canada, 1969-1980.

Hull, A. C. and J. O. Evans. 1973. Musk thistle (*Carduus nutans*): an undesirable range plant. Journal of Range Management. 26:383-385.

Kok, L. T. 1986. Impact of *Trichosirocalus horridus* (Coleoptera: Curculionidae) on *Carduus* thistles in pastures. Crop Protection. 5:214-217.

McCarty, M. K. and C. J. Scifres. 1969. Life cycle studies of the musk thistle. Nebraska Agriculture Experimental Station Research Bulletin 230.

McCarty, M. K., C. J. Scifres, A. L. Smith, and G. L. Horst. 1969. Germination and early seedling development of musk and plumeless thistle. University of Nebraska Research Bulletin 229.

McCarty, M. K. and J. L. Hatting. 1975. Effects of herbicides or mowing on musk thistle seed production. Weed Research. 15:363-367.

Roberts, H. A. and R. J. Chancellor. 1979. Periodicity of seedling emergence and achene survival in some species of *Carduus, Cirsium,* and *Onopordum*. Journal of Applied Ecology. 16:641-548.

Smith, L. M. and L. T. Kok. 1984. Dispersal of musk thistle *Carduus nutans*) seeds. Weed Science. 32:120-125.

Smyth, A. and J. L. Hamrick. 1987. Realized gene flow via pollen in artificial population of musk thistle. *Carduus nutans* L. Evolution. 41:613-619.

Stubbendieck, J., G. Y. Friisoe, and M. R. Bolick. Weeds of Nebraska and the Great Plains. 2nd edition. Nebraska Department of Agriculture. pp. 98-99.

Table 1.

Herbicide treatments for plumeless thistle control.[1,2]

Herbicide	Product per Acre	Application Time[2]	Notes
Ally	0.2-0.3 oz	Late fall or spring before bolting	Use in pastures or grasslands for seed, fallow and CRP. Curtail may be used in wheat.
Curtail	2 pt		
Escort	1 oz	Bolted plants in spring prior to flowering	Use in noncropland and roadsides. Add surfactant at 1 pint/100 gallons.
2,4-D ester (4L)	1.5-2 qt	Late fall treatment of rosettes or spring treatment before bolting	Annual treatments necessary for control of new seedlings. Fall applications after trees drop leaves and before leafing out in the spring reduces damage. Do not apply after "soil freeze-up" in the fall. For use on ranges and permanent pastures only.
2,4-D ester (4L) + Banvel/Clarity	1 qt + 0.5 qt		
Tordon 22K	8-12 oz		
Grazon P+D	2-4 pt		
Transline	0.33-1 pt		
Redeem R+D	1-2 oz		

[1]These recommendations were current as of July 1, 2002. See the NU Cooperative Extension publication, "Guide for Weed Management in Nebraska", EC-130, for current information. It's available in print at Nebraska Cooperative Extension offices or on the Web at http://www.ianr.unl.edu/pubs/fieldcrops/EC130.htm

[2]References to commercial products is made with the understanding that no discrimination is intended and no endorsement by NU Cooperative Extension is implied.

A Message From the Nebraska Department of Agriculture

The State of Nebraska has had a noxious weed law for many years. Over the years, the Nebraska Legislature has revised this law.

The term "noxious" means to be harmful or destructive. In its current usage "noxious" is a legal term used to denote a destructive or harmful pest for purposes of regulation. When a specific pest (in this case, a weed) is determined to pose a serious threat to the economic, social, or aesthetic well-being of the residents of the state, it may be declared noxious.

Noxious weeds compete with crops, rangeland, and pastures, reducing yields substantially. Some noxious weeds are directly poisonous or injurious to man, livestock, and wildlife. The losses from noxious weed infestations can be staggering, costing residents millions of dollars due to lost production. This not only directly affects the landowner, but erodes the tax base for all residents of the state. The control of noxious weeds is everyone's concern and their control is to everyone's benefit. The support of all individuals within the state is needed and vital for the control of noxious weeds within Nebraska.

It is the duty of each person who owns or controls land in Nebraska to effectively control noxious weeds on their land. County boards or control authorities are responsible for administration of noxious weed control laws at the county level. This system provides the citizens of Nebraska with "local control". Each county is required to implement a coordinated noxious weed program. When landowners fail to control noxious weeds on their property, the county can serve them with a notice to comply. This notice gives specific instructions and methods on when and how certain noxious weeds are to be controlled.

The Director of Agriculture determines which plants are to be deemed as "noxious" and the control measures to be used in preventing their spread. In Nebraska, the following weeds have been designated as noxious:

Canada thistle (Cirsium arvense (L.) Scop.)
Leafy spurge (Euphorbia esula L.)
Musk thistle (Carduus nutans L.)
Plumeless thistle (Carduus acanthoides L.)
Purple loosestrife (Lythrum salicaria L. and L. virgatum - including any cultivars and hybrids)
Knapweed (spotted and diffuse) (Centaurea maculosa Lam. and C. diffusa Lam.)

Whether farmer or rancher, landowner or landscaper, it's everyone's responsibility and everyone's benefit to aid in controlling these noxious weeds. If you have questions or concerns regarding noxious weeds in Nebraska, please contact your local county noxious weed control authority or the Nebraska Department of Agriculture.

Plumeless Thistle

Illustration of the plumeless thisle is by Bellamy Parks Jansen; originally published in *Weeds of Nebraska and the Great Plains*. Used with permission of the publisher, the Nebraska Department of Agriculture.

Nebraska
Lincoln

Published by University of Nebraska Cooperative Extension in cooperation with and with financial support from the Nebraska Department of Agriculture.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Elbert Dickey, Dean and Director, University of Nebraska, Institute of Agriculture and Natural Resources.