

## Ecology and Management of Hoary Alyssum (*Berteroa incana* (L.) DC.)

By

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**Figure 1. Hoary alyssum growing next to alfalfa.**

### Abstract

Hoary alyssum, a member of the mustard family, is an annual to short-lived perennial forb native to east-central Europe and western Asia. It has a slender tap root, star-shaped hairs on the stems, leaves, sepals, and seed pods, and four white, notched petals on flowers clustered at the stem tips. Dependent on seed production to maintain populations and to spread, flowering begins in late spring and lasts through fall enabling a single plant to produce over 2,500 seeds when growing on open ground. First reported from Ontario, Canada in 1893 and the northeast coast of the U.S. in 1897, it spread to Montana by 1905 and currently is reported from 27 Montana counties (a distribution map of hoary alyssum can be found at the University of Montana Invaders Database at <http://invader.dbs.umt.edu/>). It was designated a category 1 noxious weed in Montana in 2008. In the 1950s and 1960s, hoary alyssum began to proliferate in forage crops, pastures, and rangelands. It is opportunistic and fills voids left in disturbed areas and on over-grazed range and pastureland (see Figure 1). Toxicity to horses has been reported when green or dried forage is contaminated by more than 30%. Infestations reduce the species richness of pollinator communities because they attract a minimal number of pollinating insects.

Hoary alyssum can be controlled using 2, 4-D applied at bloom. Re-applications will be required to prevent seed production. There are no biological control insects available and grazing management has not been developed. Prescribed grazing to maintain the vigor of forage species will prevent invasion and retard spread. In forage production fields, nutrient management, irrigation management, and crop rotation to maintain vigorous forage plants will prevent hoary alyssum invasion and reduce spread.



**Figure 2.** The basal rosette of hoary alyssum with long-stalked, oval-lanceolate leaves.

## **PLANT BIOLOGY**

### **Identification**

Hoary alyssum is a member of the mustard family (Brassicaceae). It has a slender tap root capable of deep soil penetration. The basal rosette has oval-lanceolate leaves broadest at the tip and 1.2 to 2 inches (3-5 cm) long including the long stalk (see Figure 2). Flower stems are erect or semi-erect growing seven to 30 inches (20-70 cm) tall and usually branched at the top (see Figure 3). Multiple stems are common. Stem leaves are alternately arranged, similar to rosette leaves in shape but smaller with less of a stalk, or stalkless. The margins of all leaves are entire with no teeth or lobes.



**Figure 3. The leaves, inflorescence, flower, and silicles of hoary alyssum.**

The small flowers (3 mm across) have long pedicels and are clustered at the stem tips in racemes. The four ovate sepals are green with white margins. There are four snowy-white petals narrow at the base and spreading at the tip with a deep cleft or notch (see Figure 4). There are two short outer stamens and four long inner stamens, four nectaries, and one pistil with a long style. The seed pods (silicles) are ellipsoid to ovoid, five to eight millimeters long, slightly inflated with the persistent style at the tip. They are appressed to the stem on the long pedicel. The seed pod has two chambers divided by a translucent septum or membranous partition which remains on the pedicel after seeds disperse. Each seed pod contains four to 12 dark reddish-brown, small (1-1.5 mm) lens-shaped seeds with narrow wings on the margins. The leaves, stems, sepals, and seed pods are covered with star-shaped (stellate) hairs that give the plant a grayish appearance from which the common name descriptor, hoary, is derived.



**Figure 4. Hoary alyssum flowers.**

## **Life History**

Seeds can germinate from early spring to late fall, limited mainly by water. Seedlings establishing in early July or sooner can flower and produce seed by early fall, thus reproducing as annuals. Seedlings establishing in late July or later will remain as rosettes and produce flowers and seeds the following year, reproducing as winter annuals or biennials. Short-lived perennial reproduction was observed in plants that re-grew after alfalfa cutting. Rosettes, but not flowering plants, accumulate non-structural carbohydrates (sugars) in the roots until the first hard frost. These sugars are needed for winter hardiness, respiratory maintenance during dormancy, and growth following dormancy, and therefore rosettes generally survive winter, whereas flowering plants do not.

Hoary alyssum has low water requirements. In a study in Germany, germination and establishment were limited by the availability of open sites and water. However, once established, light was more important for growth and reproduction than water. In a Wisconsin alfalfa field, hoary alyssum did poorly where alfalfa was vigorous with a shading canopy, but thrived when alfalfa growth was poor. Similar to most mustard plants, hoary alyssum does not host arbuscular mycorrhizal (AM) fungi and had high mortality when grown experimentally in nitrogen-enriched soil and in the presence of adjacent plants inoculated with AM fungi.

Hoary alyssum reproduces only by seed. Flowers are insect pollinated, predominantly by small insects able to access the shallow nectaries in the small flowers, including syrphid and other flies (Diptera), wild bees, and wasps (Hymenoptera). Spring flowering plants are able to produce large numbers of seeds when grown in the open. In Minnesota, biomass production was 10 times greater, and seed production was 20 times greater from plants grown in open areas compared to vegetated areas. In North Dakota, seed production averaged 2,530 seeds per plant. Herbicide studies suggest hoary alyssum can form a persistent seed bank and seeds can remain dormant and viable for several years.

## **Habitat**

Hoary alyssum is adapted to the temperate continental climate characterized by cold winters and hot dry summers. Fall seedlings and rosettes are resistant to winterkill, and flowering plants are resistant to summer drought. The plant grows well on sandy or gravelly soils with poor soil fertility, and is most prolific on dry, disturbed open sites. It is commonly found on limestone and calcareous substrata and less so on acidic soils. It is common in fields of alfalfa, clover, or birdsfoot trefoil. In Montana it has been found along roads, railroads, trails, and gravelly stream and lake banks, in lawns, farmyards, vacant lots, overgrazed pastures and rangeland, and in hay meadows.

## **Spread**

Hoary alyssum is believed to have been originally transported to North America as a contaminant of clover and alfalfa seed. Contaminations of forage and lawn seed, as well as contaminated hay, are still considered likely means of long distance seed dispersal. Hoary alyssum seed may also disperse long distances on mowers, other machinery, and in contaminated soil and gravel. Seeds disperse through valves in the seed pod. It is believed most seed falls near parent plants. However, the winged margin and light-weight seed may enable wind and

water dispersal, and animals consuming the seed pods may disperse seed in their droppings, although there is no information to support this.

## **Impacts**

Hoary alyssum began to increase in hay fields and pastures in the 1950s and 1960s, particularly under conditions of drought, overgrazing, or poor soil fertility. It decreases forage value because the woody stems of mature plants are low in crude protein and digestible carbohydrates. Contamination of 30% or more of forage with hoary alyssum is toxic to horses causing laminitis, limb edema, diarrhea, intravascular haemolysis, and hypovolemic shock. Its ability to persist under dry conditions and its continuous flowering and fruiting enables it to compete with native plants on range and wildlands and reduce biodiversity. In Minnesota it has been implicated in the reduction in species richness of pollinator communities because it attracted a minimal number of pollinating insects.

## **MANAGEMENT ALTERNATIVES**

### **Herbicide<sup>1/</sup>**

Hoary alyssum populations can be temporarily suppressed using 2, 4-D applied at label rates. Spring applications when plants are actively growing and prior to bolting will be most effective. Because hoary alyssum germinates and establishes throughout the growing season, repeated applications will be needed to target plants regenerating from the seed bank. Reports indicate metsulfuron applied at 0.5 ounce product (Escort®, Rainbowgreen Metsulfuron®, and others) per acre will control hoary alyssum, although hoary alyssum is not listed on the label. Other sulfonylurea herbicides including chlorsulfuron, and trisulfuron products as well as dicamba, and imazapic products may also be effective. Consult your Extension Agent for herbicide recommendations. Glyphosate will control hoary alyssum on seedbed preparation treatments. Studies are needed to develop herbicide recommendations for this weed.

**Hand Pulling.** Hand pulling that removes the root crown is an effective method to temporarily reduce hoary alyssum on small-scale infestations and scattered plants that are either newly invading or persisting after herbicide treatments. Pulling or grubbing the root crown is most easily accomplished when the soil is moist and a shovel is used to pry-up the tap root. When the soil is dry, the plant tends to break off above the root crown enabling regeneration. Pulling should be repeated as plants regenerate from the seed bank or from remaining root crowns. Plants with seed pods should be burned if conditions permit or sealed in plastic bags and disposed of in the trash to prevent seed spread.

**Mowing.** Mowing will not control hoary alyssum and may increase infestations by cutting down a shading canopy and spreading seed pods. Regular, repeated mowing to a six-inch stubble height may reduce seed production when combined with irrigation and nutrient management to increase the vigor of desired plants. If the mowing equipment is subsequently used on weed-free areas, washing equipment after use will help prevent the spread of this weed.

<sup>1/</sup>Any mention of products in this publication does not constitute a recommendation by the NRCS. It is a violation of Federal law to use herbicides in a manner inconsistent with their labeling.

**Tilling.** Shallow tilling that severs the tap root below the root crown will kill hoary alyssum plants. However, this type of disturbance will favor hoary alyssum regeneration from the seed bank. Multiple tilling or tilling followed by application of herbicide to target establishing seedlings can be used to exhaust the supply of viable seeds in the soil. Tilling is only recommended in cropland or in combination with seeding perennial competitive plants. As with any mechanical treatment, equipment should be washed after working in an infestation and before it is used on weed-free areas.

**Irrigation.** Hoary alyssum thrives under dry conditions. Irrigation can be used to increase the production of many forage plant species in cropland and pastures and increases their competitiveness with hoary alyssum. Good irrigation management combined with nutrient management of forage crops can prevent hoary alyssum invasion and help reduce infestations through plant competition.

**Fertilization.** Hoary alyssum thrives on sites with poor soil fertility. On cultivated pastures and hay meadows, nutrient management is important to maintaining the competitiveness of desired perennial grasses over hoary alyssum. Nutrient management combined with judicious use of herbicides and crop rotation is recommended where hoary alyssum invades non-native pastures and hay meadows.

**Prescribed Burning.** There is no information on prescribed fire effects on hoary alyssum. Fall burns may reduce seed production if seed pods are burned before seed release. Fire may create a disturbance favorable to hoary alyssum establishment and sites should be monitored for weed occurrence and follow-up weed control should be applied where weeds are found.

## **Grazing Management**

Grazing animals have not been used to control hoary alyssum. Domestic and wild mammals consume hoary alyssum where it occurs in sufficient quantities, and poisoning has only been reported in horses. Lambs rejected hoary alyssum in a Minnesota forage field trial. Goat utilization of weed-free hay was greater than utilization of hay contaminated with hoary alyssum in a Wisconsin study. Studies specific to using these animals to manage hoary alyssum are needed. Cattle will utilize hoary alyssum in their forage areas but they generally select more digestible forages. Prescribed grazing to maintain the competitiveness of forage plants is important to prevent the spread of hoary alyssum in pastures and on rangeland, because the disturbance of overgrazing favors hoary alyssum establishment and reproduction.

## **Biological Control**

There are no biological control insects available for management of hoary alyssum.

## **Revegetation**

Sustainable suppression of hoary alyssum populations is more likely with desirable perennial plants that will compete for light, water, and nutrients. On disturbed sites and sites where the competitive vegetation has been lost, re-vegetation may be necessary to establish a competitive plant community. In forage crop fields, crop rotation is important for weed control and keeping the crop vigorous and competitive. For example, hoary alyssum increased in Wisconsin when five-year varieties of alfalfa replaced three-year varieties.

Species selected for revegetating disturbed sites and hoary alyssum infestations should be appropriate for management objectives, adapted to site conditions, and competitive with the weed. Management objectives will determine if non-native forage species or native species are seeded and species mixture components. The environmental conditions of the site, including precipitation, soil texture and depth, slope and aspect will affect species establishment. On native rangeland, a diversity of perennial grass and forb species that occupy many niches over time and space will most fully utilize available resources and compete effectively with hoary alyssum. Refer to [Montana Plant Materials Technical Note 46](#), 'Seeding Rates and Recommended Cultivars,' and Extension Bulletin EB19 'Dryland Pasture Species for Montana and Wyoming' for seeding rate guidance and revegetation species selection. State, area, and field resource specialists can help determine the most appropriate, site-specific species mix and timing of seeding for local conditions.

### **Integrated Pest Management (IPM)**

Hoary alyssum thrives on disturbed ground with poor fertility and dry conditions. On hay ground, IPM practices include crop rotation, nutrient management, and irrigation management (where available) to maintain competitive shading forage plants. New infestations of hoary alyssum should be aggressively controlled using hand pulling and broadleaf herbicide. Based on data from Wisconsin alfalfa field trials, herbicide application was recommended as soon as possible after the last forage harvest in early fall. On pastures and rangeland, herbicide application should be combined with prescribed grazing. In farm yards, herbicide application and hand pulling should be used particularly where hay, tillage, and harvest equipment are stored. Equipment should be clean before taken to the field. Roadways, trails, and irrigation ditches should be maintained free of weeds.

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