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Bindweed Identification and Control Options for Organic Production

Laurie Hodges
University of Nebraska&#8211Lincoln, lhodges1@unl.edu

University of Nebraska Lincoln

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Bindweed Identification and Control Options for Organic Production

By Laurie Hodges, Extension Vegetable Specialist

Two species of bindweed are commonly found in the Great Plains and one unrelated weed is often confused with bindweed. **Field bindweed** (*Convolvulus arvensis*) is also known as small morning glory. It has smooth, slender stems two to seven feet long that twine or spread over the soil surface. The leaves are shaped like arrowheads. The white or pale pink flowers are about one inch across. Field bindweed has a deep, extensive root system and is able to persist and thrive with equal ease in uncultivated or most crop situations. It is considered one of the most serious weeds in the region and is on the noxious weed list for Colorado, Kansas, South Dakota, Iowa and Missouri, requiring whoever owns or manages the land to control this weed. It is not on the noxious weed list for Nebraska, but is a problem for many growers.

Hedge bindweed (*Calystegia sepium;* previously classified as *Convolvulus sepium*) is found throughout the United States in waste areas and fence rows, but is most common in the eastern plains states. It is very common in eastern Nebraska. The roots of hedge bindweed are relatively shallow but very extensive. Leaves of this species are larger than those of field bindweed and are hairless. Hedge bindweed flowers are 1 1/2 to 2 inches across, white or pinkish. Each fruit contains a single seed with sharp angles and pointed ends. The stems are smooth and three to ten feet long, often twining on other plants or trailing along the ground. It is more common on bottom lands than field bindweed and is less drought tolerant. Under humid conditions, however, it can be a more serious problem than field bindweed. Control practices are similar for both species of bindweed.

Black bindweed or wild buckwheat (*Polygonum convolvulus*) is often confused with true bindweed; however, it is an annual with slender stems trailing on the ground or twining about other plants. The leaves are heart-shaped with the basal lobes spreading and a small papery sheath encircles the stem at the leaf base. The flowers are very small and green. Each plant can produce 11,000-30,000 seeds between June and September. Although most of the viable seed will germinate the following year, seeds can remain viable for about five years. This plant is a strong climber and can compete for light in dense crop stands. It can spread rapidly and is highly competitive for moisture and nutrients. Allowing the seeds to germinate prior to tillage provides moderately effective control since it is an annual weed. It is common in small grain crops, for which there are several chemical controls. It is easier to control then field bindweed or hedge bindweed.

Field Bindweed

Field bindweed is a serious problem for many growers. The root system consists of vertical roots extending as much as 30 feet below ground and shallow, horizontal lateral roots. The deep vertical roots contribute to the persistence of this weed; however, 70 percent of the root system is in the top 2 feet of soil. Bindweed experiments have provided estimates of bindweed root production of 2.5 to 5 tons per acre in one year. Most parts of the bindweed root can produce adventitious buds, which can create new roots and shoots. Roots capable of budding were found as deep as 14 feet. Fragments of vertical roots as short as two inches can form new plants. At about 15 to 30 inches from the parent plant, a lateral root may turn downward and become a secondary vertical root, sending out both roots and shoots from the turning point. By this means a single field bindweed plant can spread more than 10 feet in a growing season. This extensive underground network allows for overwintering and persistence of the plant in the soil for many years.

Field bindweed is more of a problem in heavy soils but can persist in all soils. Seeds can remain viable in the soil for at least 50 years. Bindweed is relatively easy to control by cultivation if caught as a very young seedling. However,

once five true leaves have formed (the plant is approximately six inches long), it develops reproductive buds on an extensive root system and becomes extremely difficult to control. Field bindweed is a prostrate plant unless it climbs on an object for support. Under warm, moist conditions, leaves are larger and the vines are more robust than under drought conditions.

An average field bindweed plant produces about 550 dark brown seeds. Within one month after forming, the seed coat matures and becomes impervious to water. Once the seed coat is weakened by mechanical abrasion in the soil or freeze/thaw cycles during the winter, seed will germinate when temperatures range between 41°F and 104°F. Field bindweed is drought tolerant and when water is withheld, bindweed competes better than most other plants. If the area is well watered, other plants may compete better than bindweed. If there is a drought, the plant reduces its seed production first and then reduces growth and leaf size. Some flowers and seeds still will be produced and the roots can persist.

Management

Organic control of field bindweed is not easy, and it cannot be accomplished with a single treatment or in a single season. Effective control requires prevention of seed production, reduction of stored carbohydrates by deep tillage of the root system, competition for light from other plants, and constant vigilance in removing top growth.

Prevention

Three practices can reduce the possibility of introducing field bindweed:

1. Buy and plant clean seed and ornamental stock.
2. Remove any seedlings before they become perennial plants.
3. Prevent any bindweed plants from producing seed.

If topsoil is introduced to a site, it should be free of bindweed vegetative parts and seeds. It is important to control new infestations when they are small because spot control is least expensive and most effective.

Cultural Control

Experiments in some annual and perennial crops have demonstrated the effect of shade on bindweed growth. Alfalfa, legumes, cereal grains, and corn reduced bindweed growth. Shrubs and trees also should reduce growth, especially if there is another planting under the trees and the bindweed is not allowed to climb above the plant foliage. Generally speaking, relying on competition to prevent bindweed infestations is of limited value since the plant will twine toward any available light. Planting alfalfa into an area infested with bindweed may help since a good stand of alfalfa puts the bindweed in deep shade. Repeated alfalfa cuttings also will reduce the competitiveness of the bindweed. A dense cover crop of red clover (*Trifolium pratense*) reduced hedge bindweed biomass but did not eliminate the weed in Canadian research. Research indicates that maintaining dense shade over the bindweed is an important means of using plant competition for control. A crop with early, vigorous growth in the spring may be the best competitive crop because it forces the bindweed to compete for light later in the season and reduces available moisture. Bindweed is very competitive where there are irrigation leaks or other moisture sources.

Seedlings of field bindweed are easy to control with cultivation, but only for about three to four weeks following seed germination. After that, perennial buds are formed, and control is much more difficult. Cultivation or hoeing has been partially effective in reducing established stands of field bindweed. Cultivate every two to three weeks as soon as the bindweed is 6 inches long and repeat whenever necessary. Withholding irrigation water in summer in conjunction with cultivation may help dry the site. If tillage is to be used to control bindweed, some measure of management can be achieved with repeated tillage if the soil is *dry* each time it's cultivated. Tillage is most effective when the shoots are allowed to grow about 10 days after emergence from the roots, since they continue to draw resources from the rootstock before they can produce new food resources to be stored in the roots. According to one research report, "Sixteen or more cultivations may be needed over a period of several years." An alternative is a deep cultivation of dry soil, which "will set back field bindweed enough that it will not interfere with an annual crop." Deep cultivation means using wide sweeps to cut roots and rhizomes 16 to 18 inches below the surface in dry soil — not a practical technique for most people, certainly not in the heavy soils of eastern Nebraska. For lighter soils, such as much of the vegetable production area in eastern Iowa, deep cultivation may provide sufficient control when infestations are low to moderate.

Black polyethylene mulch has been effective for bindweed control only if no light is allowed to reach the soil and the plant. The edges of the plastic must be overlapped so that the bindweed stems cannot grow between the sheets and into the light. Landscape fabrics also have been effective if all light is excluded. However, if holes are made in the fabric or plastic for plants, bindweed also can grow through these holes. A landscape fabric placed over soil then covered with bark or other organic matter or rock will control field bindweed; but it may take more than three years of light exclusion before the bindweed dies. Once the plastic is removed, new bindweed plants may germinate from seed in the soil so be sure to monitor the site and control new seedlings.

Soil solarization involves the use of clear, UV-stabilized plastic placed over moist soil during the hot summer months to increase soil temperatures to levels lethal to many soil-borne pathogens, weed seeds and seedlings,

and some soil insects. The plastic must be placed on level ground that is free of large clods or furrows and remain in place at least four to six weeks. Soil solarization has not provided effective bindweed control. Clear plastic is used because higher soil temperatures can be achieved than with black plastic; however, bindweed will grow through most clear plastic.

Biological Control

In recent years, several organisms have been evaluated as biological control agents for field bindweed and hedge bindweed. These include the fungi *Phomopsis convolvulus* and *Stagonospora convoluvuli* strain LA39; and the insect *Tyta luctuosa* (Lepidoptera: Noctuidae). In general, the various biocontrol agents reduced the bindweed biomass or foliage but did not reduce the regrowth the year following application, necessitating yearly applications of the biocontrol agent. It is unknown if long-term suppression of foliage by biocontrol agents would eventually eliminate this persistent weed.

Chemical Control

There has been considerable discussion regarding the use of vinegar for weed control. Legally, if a product isn't registered and labeled as a herbicide for use on the specific weed and crop combination, it cannot be sold or used as one. Although some commonly available products such as boiling water and salt will kill plants at some dose, generally the control is non-specific, affecting all plants to some degree. Also, plants often can rejuvenate from deeper root systems. Regular vinegar sold in grocery stores is five percent acetic acid. At this concentration, research has shown weed control to be marginal. While higher concentrations may be more effective, there are several limitations to using acetic acid as a weed control agent for bindweed or any other weed. Due to the acidity, sprayer parts including brass and rubber parts may be damaged. Higher concentrations can be extremely hazardous to prepare and use as the acid is highly corrosive and can cause permanent lung and corneal damage (blindness) as well as severe burns. More information on this topic is available on the Iowa State University web site, *http://www.weeds.iastate.edu/weednews/vinegar.htm,* the Washington State University web site, *http://wsprs.wsu.edu/VinegarFactSheet.pdf,* and at the USDA web site at *http://www.barc.usda.gov/anri/sasl/vinegar.html*.

For non-organic chemical control of bindweed, most herbicides such as glyphosate (Roundup, Kleenup) are most effective if applied when the bindweed is vigorously growing and has a few flowers, but is not yet in full bloom. Plants should be kept irrigated to promote movement of the herbicide into the root system. Multiple treatments will be necessary. Fall treatment is even more effective. Several herbicides commonly used in commercial row crops, ornamentals, and turf effectively control bindweed, especially when applied before seeds germinate. For chemical control of bindweed in field crops, see Nebraska Extension Circular EC 130, "Guide for Weed Management in Nebraska" available at county extension offices or on the Internet at *http://www.ianr.unl.edu/pubs/fieldcrops/ec130.htm*.

Resources

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