FIELD BINDWEED

Biology and Management

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Field bindweed (*Convolvulus arvensis* L.: Convolvulaceae) is one of the most common noxious weeds in Idaho and one of the most difficult to control. It was introduced from Europe to Virginia in 1739, and even before 1900 the U.S. Department of Agriculture recognized the weed as a national menace.

By 1900 field bindweed was established in all western states. By 1955 it was present in every Idaho county, occupying 140,000 acres of cropland. In 1989, it occupied more than 500,000 acres of Idaho cropland plus an equivalent acreage of pasture and rangeland. The only noxious weed that infests more crop acreage is Canada thistle (*Cirsium arvense* (L.) Scop.). Field bindweed also is known as morning glory, wild morning glory, corn-bind and creeping Jenny, but to avoid confusion with other species, it should be called field bindweed.

Crop yields are often reduced 50 to 60 percent where field bindweed infestations are dense. Field bindweed has a deep root system that competes with crop plants for water and soil nutrients. Bindweed vines climb on plants and shade them, cause lodging of small grains, and complicate tillage and harvesting by clogging machinery and entangling plants. Agricultural land infested with field bindweed is reduced in resale value.

STATE LAWS

Field bindweed is a noxious weed species under the noxious weed laws of many states. It is a designated "primary noxious weed" in the Idaho Pure Seed Law, which prohibits the sale of seed containing seeds of any primary noxious weed. All crop seed offered for sale in Idaho must be tagged to show it is free of these pests. The tags also give the percent purity and germination of the crop seed. Clean seed of adapted crop varieties is always a good investment.

The Idaho seed certification law prohibits certification of crop seed that contains field bindweed seeds or that comes from fields in which field bindweed was found during the field inspection phase of the certification process.

The Idaho Noxious Weed Law requires control of field bindweed except in special management zones. Where control is required, aboveground growth must be destroyed and prevented from producing seed. This law also prohibits transport of live seeds or roots.

DESCRIPTION

Several strains of field bindweed differ in leaf size and shape, flower color and growth habit (Fig. 1). However, they all share the following characteristics:

Growth habit

Field bindweed is a perennial species with creeping roots and slender green, weak, twisted and vining stems that may grow as long as 6 feet. When plants grow alone, their stems lie nearly flat on the ground. When they grow with upright plants, they climb, binding together all plants within a field bindweed colony or patch.

Field bindweed normally grows in circular patches because it creeps in every direction. Cultivation may change this pattern.

Leaves

Although field bindweed leaves vary in size and shape, they always are shaped like an arrowhead with two pointed basal lobes that usually extend at right angles to the leaf midvein. They have no stipules and are borne on a petiole (leaf stalk).

The leaf blade is usually blunt-tipped with a tiny point at its end. In some strains, the blade is sharply pointed.

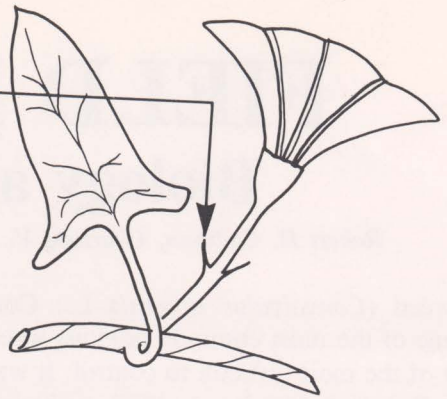
Field bindweed

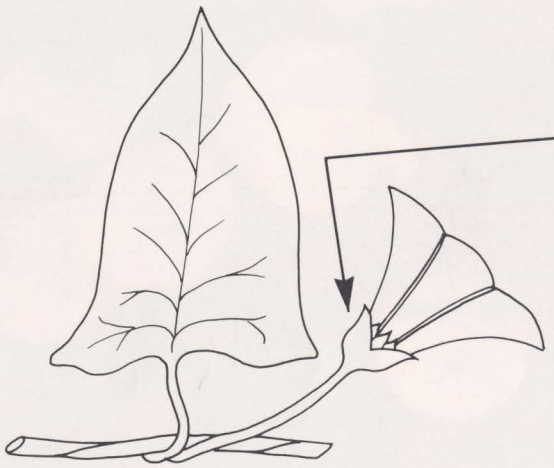
small bracts well below flower

Leaf: Arrowhead shaped, up to 2½ inches long, tiny point on rounded leaf tip. Basal lobes point at nearly right angles to midrib. No stipules. 1 leaf per node.

Flower: Funnel-shaped, up to 2½ inches long. ¾ to 1 inch across. White to pink. Stalk has 2 bracts ½ to 2 inches below the flower. Flower folds at night.

Stem: Twisted, green.





Hedge bindweed

large bracts enclosing flower base

Leaf: Sharply pointed. Blade up to 8 inches long. No stipules. 1 leaf per node.

Flower: 1½ to 2 inches across. 2 to 3 inches long. White to pink. Bracts are large, at base of petals. Distinct points on calyx lobes.

Stem: Green, very slight twist.

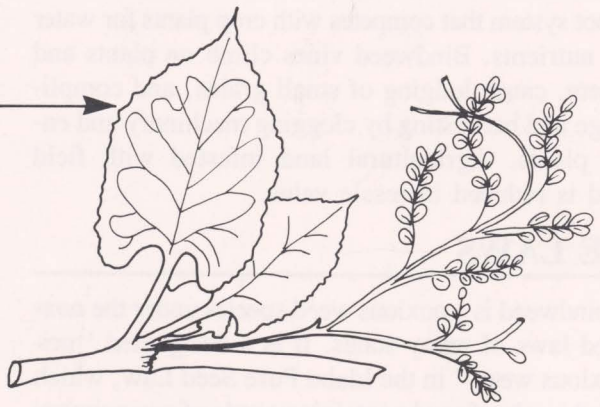
Russian vine

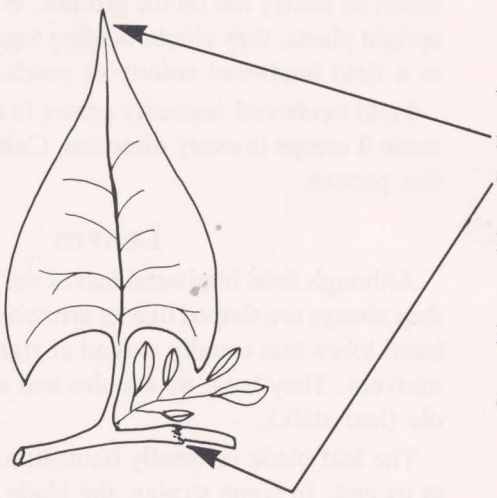
Ruffled edge

Leaf: Sharply pointed, up to 2½ inches long. Ruffled edges. Rounded basal lobes. Sheathing stipules. 2 or more leaves per node.

Flower: Small, white, in profuse bunches.

Stem: Brown woody lower part. Green upper part, not twisted.





Wild buckwheat

narrow, sharp point sheathing stipule

Leaf: Arrow shaped. Sharply pointed. Basal lobes point opposite to leaf tip. Up to 3 inches long. Sheathing stipules. 1 leaf per node.

Flower: Small, green to white, inconspicuous, 1 triangular seed per flower.

Stem: Red to white, not twisted.

Fig. 1. Field bindweed and species resembling it (distinctive differences in field bindweed compared to similar weeds are labeled).

Leaves are dark green and vary from smooth to slightly hairy. They are usually ½ to 1 inch long but vary in size depending upon the strain and growing conditions.

Flowers

The flowers are borne in the leaf axils (at the junction of leaf and stem). They have pink to white petals that are fused into a funnel. From 1½ to 2 inches below each flower are two tiny bracts. From buds in the bracts' axils, secondary flowers can grow.

Flowers are faintly scented, and about 1 inch in diameter and ½ to 1 inch long. The exterior of each flower has five lengthwise, thickened strips that may be light green or pink. Flowers fold at night to form a 5-part twisted tube and open during the day. Blooming starts about 4 weeks after emergence in midspring and continues until the plant dies from autumn freezing.

Seeds

A pure stand of field bindweed can produce 22 million seeds (about ¾ ton) per acre. Seeds are mature about 3 weeks after flowers bloom but have been known to germinate within 10 days of the time flowers open.

The seeds are contained in two-sectioned capsules, each with one to four (normally four) seeds. Seed shape is determined by the number of seeds in each capsule. When four seeds form, each one has two flat sides and one rounded side. When two seeds form, they have only one flat side. Occasionally, capsules have single seeds; these seeds have no flattened side. Seeds are grayish brown to black and have a rough, pebbly surface. They are readily visible in cereal grains.

Seeds are about ⅛ inch long. This, combined with their variable shape, makes them very difficult to separate from wheat, barley and other seeds in seed cleaning equipment. As a result, field bindweed seeds are common contaminants in these crops.

Field bindweed seeds have a hard, impervious seed coat that enables some seeds to remain dormant in the soil for many years. Bindweed seeds have germinated in a field even after no bindweed seed production had been allowed for 28 years.

Roots

Field bindweed spreads primarily by roots when weed control practices suppress flowering and where tillage implements carry roots to uninfested areas. Roots can penetrate 20 feet deep in soil but normally do not send up shoots from any deeper than 2 feet. Buds at various intervals along lateral roots can send up new plants. Broken root segments as short as 1 inch can produce new shoots.

Seedlings

Bindweed seedlings can be identified easily by their two heart-shaped cotyledons or seed leaves. Seedlings develop a deep tap root about 6 weeks after emergence. They then develop lateral roots that in turn produce new plants that repeat the process. Tillage can readily control the seedlings until they are about 6 weeks old. After they develop lateral roots, the plants resist mechanical control, but they usually are not difficult to control with herbicides until they are 2 to 3 years old.

Similar species

Hedge bindweed

Hedge bindweed (*Convolvulus sepium* L.: Convolvulaceae) occurs in waste areas and fencerows. It is nearly identical to field bindweed but has much larger, hairless leaves and flowers that measure 1½ inches across. At the flower base, two large but not overlapping bracts enclose the flower calyx.

The only reported location of hedge bindweed in Idaho is in Ada County, but it is common in western Oregon and Washington. Hedge bindweed should be reported to the county weed supervisor and the UI Weed Diagnostic Center[1] whenever it is found. Several other bindweeds occur in the United States, but none has been reported in Idaho.

Annual morning glory

Annual morning glory (*Ipomoea purpurea:* Convolvulaceae) is a related, commercially available ornamental species that is rarely weedy in the Northwest. Varieties of this species have much larger, showy flowers of various colors. Because it is an annual, it is more easily controlled by cultivation.

Wild buckwheat

Wild buckwheat (*Polygonum convolvulus:* Polygonaceae), sometimes called black bindweed, occurs throughout Idaho and often is mistaken for field bindweed. This annual species has a twining growth habit and leaf sizes and shapes similar to those of field bindweed. It is distinguished easily by the following characteristics: (1) untwisted, often red or white stems, (2) tiny, inconspicuous flowers in groups at the leaf axils, (3) leaves with inconspicuous but distinctly sheathing white stipules, (4) leaf blades with basal lobes that point downward and (5) long, very pointed leaf tips that do not vary in shape.

Each flower has a single seed that is distinctly triangular in cross-section, with sharp angles and sharply pointed ends. The plant is not unusually hard to control and seldom occurs outside of cropland, gardens or ornamental plantings.

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[1]Weed Diagnostic Center, College of Agriculture, University of Idaho, Moscow, Idaho 83843.

Russian vine

Russian vine (*Polygonum auberti:* Polygonaceae) has woody stem bases and may climb as high as 30 feet on trees and poles. Its leaves have nearly the same size and shape as field bindweed leaves, but they have sharp, narrow tips more like those of wild buckwheat and distinctively ruffled edges, especially when young. The flowers are small, in showy bunches. Russian vine is uncommon in Idaho.

Many other species have leaf shapes similar to field bindweed's, but lack twisted, vining stems.

SPREAD

The primary means of long-distance spread is by seed, but once a seedling becomes established, a patch or colony forms and spreads by extending lateral roots. The spreading root system enables undisturbed patches in crops to enlarge 6 to 10 feet in diameter per year. Such patches tend to be circular.

Under favorable soil moisture conditions, sections of the roots may start new patches when they are carried by tillage equipment to clean portions of the field. Keep field equipment out of isolated bindweed patches except when weed control operations are in progress.

Grains or forages containing mature field bindweed seeds should not be fed to animals unless they are ground or otherwise processed to destroy the field bindweed seeds. Seeds can pass through animal stomachs with little or no damage.

CONTROL AND MANAGEMENT

Field bindweed can be controlled with biological agents, chemicals and cultivation and by integrating these methods into certain cropping practices. Nevertheless, the infestation will survive for many decades in the dormant seed stage. Total eradication is not a realistic short-term goal where seeds lie dormant in the soil; but with diligence, you can eliminate roots after a few years, leaving only the more easily controlled seedlings to contend with. At that point, the infestation causes negligible crop losses. The best control methods and materials depend on the size of the infestation and the conditions under which the weed is growing.

Utilization

Although field bindweed is not a productive forage, sheep have grazed it in the United States with no reported ill effects. Continuous, intensive sheep grazing over a period of several years can temporarily suppress field bindweed. Afterward, it will recover fully if undisturbed. Grazing that is intensive enough to control field bindweed destroys desirable grass species, opening the way for erosion and more weed invasion.

Cattle do not readily graze field bindweed, and hog poisoning has been reported. Other members of the morning glory family have been reported to possess purgative properties and have produced a poorly defined illness in sheep, cattle and goats. As a result, heavy grazing on dense stands of field bindweed appears to be risky. Small amounts (5 to 10 percent by weight) of field bindweed in an animal's diet have produced no reports of adverse effects. Grazing field bindweed after seed maturity can result in weed spread because seeds pass through livestock and germinate. Any transport of noxious weed seeds, even in animals, violates the Idaho Noxious Weed Law.

Biological control

Competition

Perennial grasses can compete well with field bindweed. Because most such grasses begin growth much earlier in the season than field bindweed does, they take early advantage of limited soil moisture and establish a canopy that competes with field bindweed for light.

Bindweed will persist in rangeland, pasture and lawns in a suppressed condition and will grow vigorously if competitive species are absent or overgrazed. Competition from desirable grasses can be enhanced by avoiding early and mid-spring grazing, applying nitrogen fertilizer and reseeding where needed.

Alfalfa can be used to hold bindweed in check but will not crowd it out. Alfalfa may, however, be used as a soil-building crop in a rotation designed to control bindweed by other means. This may be especially useful under dryland conditions.

To obtain maximum benefits from any cropping method, grow healthy, vigorous crops. For maximum crop yield, test the soil to determine crop needs and apply the necessary fertilizer. This will improve the crop and help suppress bindweed.

Parasitism

Parasitic organisms for biological control are under investigation but have not yet resulted in substantial control of field bindweed. Several insect and mite species attack field bindweed in its native habitats in Europe and Asia. Some of these species already exist in the United States and Canada. Several are now in Idaho or being tested for future release (Table 1).

Many insects that feed on field bindweed also damage native and ornamental morning glories (*Ipomoea* and *Calystegia* spp.) as well as sweet potato (*Ipomoea batatus*). The U.S. Department of Agriculture will approve the release of only those insect and mite species that damage field bindweed only.

Parasites that occasionally damage field bindweed — A leaf-mining moth (*Bedellia somnulentella*) and a defoliating moth (*Emmelina* (=*Oidaematophorus*) *monodactyla*)

Table 1. Insect and mite parasites of field bindweed that are present in Idaho or being tested for possible release.

Insect or mite	Type	Plant parts attacked	Damaging stage(s)	Possible release dates	Potential for benefit
Bedellia somnulentella	moth	leaves	larvae	present	poor
Emmelina monodactyla	moth	leaves	larvae	present	poor
Metriona bicolor	beetle	leaves	larvae, adults	present	poor
Tetranychus urticae	mite	leaves	larvae, adults	present	poor
Tyta luctuosa	moth	leaves	larvae	1990s	good
Aceria malherbae	mite	buds, leaves	larvae, adults	1990s	good

occur in Idaho and other parts of the United States. These insects may attack bindweed early in the season and can sometimes cause significant damage. Parasitism and predation of these moths by other insects limit their effectiveness. These moths have a broad host range that includes sweet potato, discouraging their use or further distribution for biological control in the United States.

The golden tortoise beetle (*Metriona bicolor*) and other tortoise beetles commonly are found on native morning glories and sometimes on field bindweed in the western United States. Feeding by adults and larvae generally results in minor damage to foliage.

The two-spotted spider mite (*Tetranychus urticae*) and other mites can cause considerable damage to bindweed foliage. Unfortunately, this suppresses the plant little because it occurs late in summer. These mites have a broad host plant range that includes many important crop plants. They are not considered valuable in weed suppression.

Parasites of potential benefit — The only imported insect that has been tested successfully and approved for release in parts of the United States is the European moth (*Tyta luctuosa*). Caterpillars of this moth defoliate bindweed, usually in the later part of the growing season. This is unlike the other moths, *Bedellia* and *Emmelina*, which feed early. This moth has not been released on a large scale to date; thus, its biology and impact under U.S. conditions are unknown.

A gall-forming mite, *Aceria malherbae*, might have a role in the eventual biological control of field bindweed. Its feeding deforms bindweed buds and leaves. Studies on the mite's host plant specificity are incomplete and no plans for release have been made. The insects and mites described here are unlikely to provide satisfactory control unless they work together with other agents.

Biological control of field bindweed with parasitic organisms is not promising. Field bindweed's extensive root system, which limits control by other methods, also limits the ability of insects and mites to control the weed. In annual cropping systems, biological control parasites are not expected to provide practical control of bindweed because they are seriously damaged by insecticides, tillage and various other farming and gardening practices. Parasites also appear unlikely to control bindweed in lawns, gardens or ornamental plantings. Eventual use of biological control parasites is expected to be limited to range, pasture, forest and other noncropped areas.

Cultivation

Fallow cultivation

Bindweed control by tillage requires 3 to 5 years of consistent, frequent cultivation. Field bindweed stores its food reserves in the roots and will yield only to a thorough, well-timed cultivation program. The best time to start a cultivation program is immediately after harvest.

After harvest, plow 6 inches deep. Then, beginning 12 days after the bindweed emerges, cultivate every 14 days until the bindweed shoots are killed by freezing. Resume tillage in the spring 12 days after the bindweed emerges. Repeat this cultivation every 14 days until bindweed no longer appears. This requires 3 to 5 growing seasons without cropping. Consistency is crucial. A month's lapse can set the program back a year or more.

Use a cultivator that cuts off all of the plants such as a rod weeder or sharp, duckfoot-type cultivator with adequate overlap of the sweeps. Cultivate no deeper than necessary to completely cut off all of the shoots, usually 2 to 4 inches. Clean roots and stems from the cultivator before moving it out of each patch.

This fallow program may increase erosion on slopes. Erosion can be reduced by planting an alfalfa-grass crop or green manure crop to add organic material to the soil before cultivation and by spreading organic materials.

Cultivation in row crops

Cultivation will substantially suppress field bindweed growth in row crops, especially between rows, but will not prevent the weed from causing significant crop loss. Even though young stems emerging within crop rows may be covered with soil thrown by the cultivator early in the season, many will continue to grow. Cultivation suppresses bindweed, but it also transports roots and stems and generally results in considerable spread of the weed from localized patches. Apply other controls during times of the rotation when cultivated crops are not grown.

Mowing, pulling and burning

Removal of all field bindweed top growth by pulling or burning can eliminate all but the weed seed if repeated at least every 14 days over 3 to 5 years. Mowing is inadequate because it misses stems lying flat as well as low

leaves and flowers, and the plants will reproduce. Mowing is effective only when combined with other effective methods such as herbicide treatment. Burning is slightly less effective than cultivation, so it must be repeated more frequently than cultivation or combined with another effective procedure. Any lapse in the frequency of these treatments will set back progress toward eradication.

Herbicides

For current herbicide information, consult the *Pacific Northwest Weed Control Handbook* or other publications including the labels of specific herbicides. This bulletin mentions only those herbicides that are commonly used and currently registered. New herbicides may become available, and current label details will change over the years.

Selective herbicides

When hormone-type herbicides are used at low dose rates according to label directions, they do not harm grass crops such as grain or lawn or pasture grasses. Long-term chemical control of field bindweed depends on sufficient herbicide moving into the root system to kill roots and root buds. This requires the use of a translocated herbicide (an herbicide that moves from one plant part to another). Examples of selective, translocated herbicides are 2,4-D, dicamba (Banvel), picloram (Tordon), dichlobenil (Casoron) and triclopyr (Turflon D, which also contains 2,4-D). The translocated herbicide glyphosate (Roundup) is not selective but can be used selectively with precise application and protection of desirable plants.

Contact herbicides such as paraquat (Gramoxone) kill only the tissue they contact directly. They can kill seedlings in the cotyledon stage, but give only short-term control of field bindweed top growth because new shoots develop from root buds.

Many translocated herbicides move within plants along with sugars. Best control is achieved when the herbicide application coincides with maximum sugar movement to the roots. In a plant newly emerged from a root bud in spring, most sugar is moving upward to produce new vegetative growth. When the plant reaches the bud or early bloom stage, vegetative growth slows or stops. Most sugar produced in the leaves begins to move toward the roots.

The bud or early bloom stage is the best time to spray field bindweed. Sugar flow to the roots is also high in fall, and herbicide treatment of fall regrowth after harvest or tillage has given long-term control of field bindweed. No herbicide will be effective if the plant has gone into dormancy or semidormancy due to drought, killing frost or other adverse growing conditions.

Small grains — In irrigated areas spring-sown barley or wheat competes well with field bindweed. Most varieties may be sprayed with 2,4-D oil-soluble or water-soluble amine or with 2,4-D ester. Apply the herbicide after the grain has tillered but before the boot stage. If weather conditions prevent this application, make it after the dough stage.

Under nonirrigated (dryland) conditions, 2,4-D is less effective because winter wheat usually reaches the boot stage before the bindweed is advanced enough for most effective spraying. Spray 2,4-D before winter wheat starts to boot. 2,4-D can be applied to winter wheat after the dough stage if the first application was missed. For long-term selective control on dryland, use a crop rotation that includes at least three consecutive years of wheat or barley and apply the selective treatment each year.

After harvest, remove excess straw to expose the bindweed and irrigate the field to stimulate active weed growth. In dryland areas, regrowth of bindweed after harvest will depend on adequate fall rain before a killing frost. When bindweed runner regrowth is 10 to 14 inches in fields where no crop is growing, apply 2,4-D, dicamba, glyphosate or registered premixed combinations. The herbicide labels will specify amounts and procedures.

Using 2,4-D is less expensive than using dicamba or glyphosate, but residual bindweed control the season after a single 2,4-D application averages only 30 to 40 percent. Dicamba is more costly but more effective. Fall application of dicamba results in 70 to 85 percent control the next season. Residues of high rates of dicamba can persist in soil to injure sensitive crops the next year. Therefore, plant cereal crops only after fall application of dicamba.

Glyphosate has no soil activity, so any labelled crop may be planted after glyphosate use. Glyphosate alone has not provided consistent field bindweed control and in some tests has been no better than 2,4-D. However, combining glyphosate and 2,4-D or dicamba usually improves bindweed control compared with using the herbicides alone. Glyphosate may be best for spot treatment in situations requiring a nonresidual treatment or when a field also is infested with quackgrass or other glyphosate-sensitive perennial weeds.

Sweet corn — Field bindweed growing in sweet corn may be suppressed with 2,4-D. However, some varieties may be injured severely by 2,4-D, so consult the label, a licensed consultant and/or your corn dealer or contractor before applying 2,4-D. When corn is more than 8 inches tall, reduce corn injury by using drop nozzles to keep 2,4-D off the upper leaves and whorl.

Field corn — Field bindweed in many varieties of field corn can be treated with dicamba or 2,4-D. Dicamba may be applied until corn is at the fifth leaf stage or 8 inches tall, whichever comes first. Corn from 8 to 36 inches tall may be treated with dicamba, but drop nozzles should be

used to reduce dicamba drift. Do not use dicamba if susceptible crops such as potatoes, sugarbeets, dry beans, alfalfa, etc., are nearby.

2,4-D may be used on corn 3 to 8 inches tall. When corn is taller than 8 inches, reduce injury by using drop nozzles to keep 2,4-D off the upper leaves and whorl. Avoid using 2,4-D esters and do not make any 2,4-D applications on windy or hot days. Do not allow 2,4-D to contact any plant for which there is no label provision.

Some corn varieties will tolerate selective spraying with 2,4-D. Others, however, may be injured severely. Consult the label, a licensed consultant and/or your corn dealer or contractor before applying 2,4-D to corn.

Pasture and rangeland — In established grass pasture, apply 2,4-D, dicamba or picloram according to label directions when bindweed starts to bloom. Repeat the application whenever there is sufficient growth. Keep lactating dairy cows out of the pasture during spraying and for 2 weeks afterward. Remove meat animals at least 1 week before slaughter. The limitations of individual herbicides are specified on the label.

Potatoes, sugarbeets, peas, dry beans — For production of potatoes, sugarbeets, beans or other sensitive crops, apply 2,4-D or glyphosate the season before planting. These crops must not be planted until 2,4-D has disappeared from the soil. Allow bindweed stems to grow an average of 12 inches before this treatment.

In irrigated areas where bindweed has stopped growing, irrigate the infestation at least a month before herbicide treatment. Spray when weed growth resumes and produces 12-inch stems. Wait 2 days after treatment for herbicide uptake and movement within the plants, then irrigate the sprayed area as soon as possible to maintain the translocation process.

Wait at least 2 weeks after spraying before plowing. Retreat whenever new bindweed growth reaches 10 inches in length.

Orchard floors (apple, blueberry, cherry, grape, nectarine, peach, pear, prune, plum) — Field bindweed can be a major problem, especially in young orchards. In fruit tree crops such as those listed above, the 20-year cycle from planting to removal usually allows field bindweed to increase unless intensive control is practiced.

In most orchards, keep bare soil under trees and grass sod in the row middles. Competition from established sod will minimize field bindweed growth in the middles, while use of dichlobenil as a selective residual herbicide effectively maintains bare soil while the planting is becoming established. *Soil-active herbicides should not be applied around trees younger than 1 year old nor should they be applied to shallow, coarse, sandy or gravelly soils.*

In older plantings where bindweed is a problem in bare areas, a paraquat/glyphosate mixture has proven a successful nonselective "burn down" herbicide. Follow label instructions. Do not let the herbicide contact immature (green or thin) bark or tree foliage.

Roadside, fencerow and noncropped areas — Maintain an adapted competitive grass. Apply an herbicide as soon as field bindweed begins to bloom and reapply within 2 weeks of the appearance of new growth. Picloram, dicamba or 2,4-D may be used.

Lawns and turfs — Apply 2,4-D, triclopyr, a mixture of the two (Turflon D) or other labelled systemic broadleaf herbicides to fully expanded field bindweed leaves whenever they appear. This must be done consistently over a period of several years in order to destroy all roots. Then, kill seedlings each year, within 6 weeks of germination or before they produce six leaves, whichever occurs first.

Ornamentals — Glyphosate and some brands of 2,4-D are permitted as long as no spray mist, droplets or other forms of the herbicide contact valued plants. Herbicide application can be combined with hand pulling for effective control.

Nonselective Herbicides

Chemical soil sterilants — Use soil sterilants only on noncrop sites. Soil sterilants do not sterilize the soil; they kill or inhibit growth of plants that absorb them. Most soil sterilants prevent growth of shallow-rooted weeds only, so their use may actually result in more bindweed growth. Soil sterilants may be used in noncrop areas where high doses may be effective, but only where erosion will not occur after vegetation loss and where the sterilant will not move to sensitive nontarget areas.

Apply soil sterilants in late fall or winter so that winter moisture will move the material into the bindweed root zone. Follow label directions to prevent undesirable side effects such as off-site movement of the herbicide. Areas treated with soil sterilants should be inspected each year to ensure against bindweed emergence.

Soil fumigation provides substantial suppression, but will not completely kill field bindweed plants because the fumigant does not penetrate deeply enough to prevent the roots from producing new shoots. It cannot kill dormant field bindweed seeds.

Foliar nonselective herbicides — In noncrop, industrial, recreational and public areas where soil sterilants have been applied and field bindweed is emerging, glyphosate may be applied nonselectively. The labels for picloram, dicamba or 2,4-D permit their application in such areas at much higher, less selective doses than are used for weed control in crops. Glyphosate may be applied as a nonselective herbicide for field bindweed control before planting certain crops.

PREVENTION

1. Plant seed that is free of bindweed seeds.
2. Ensure that roughage or grain for feed contains no bindweed seeds.
3. Buy nursery stock only from nurseries that guarantee soil around the roots to be free of bindweed roots and seeds.
4. Avoid mature bindweed patches when harvesting; harvesting may distribute seeds. Transport of field bindweed seeds in crops or on vehicles or equipment violates the Idaho Noxious Weed Law.
5. Treat all bindweed infestations to kill roots and to prevent seed formation then kill seedlings that appear on the site in subsequent years.
6. Be sure tractors, tillage implements, combines and other pieces of machinery are clean before allowing them to enter your land, especially if they have been working in bindweed-infested areas.
7. Support laws and ordinances that are intended to prevent bindweed from spreading.

Pesticide residues — Recommendations for use are based on currently available labels for each pesticide listed. If followed carefully, residues should not exceed the established tolerances. To avoid excessive residues, follow label directions carefully with respect to rate, number of applications and minimum interval between application and reentry or harvest.

Groundwater — To protect groundwater, when there is a choice of pesticides, the applicator should use the product least likely to leach.

Trade names — To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

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