1935

EC35-50 Bindweed Eradication

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Circular 50 February, 1935

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A heavy infestation of field bindweed

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Field bindweed, also known as small-flowered morning glory, European morning glory, Creeping Charlie, Russian Creeper, and Creeping Jennie, is becoming each year a greater menace to farm lands. The infestation of cultivated fields with this pest lowers the yield of crops an average of 30 per cent, increases the labor costs, and reduces land and loan values. It is therefore important that land-owners learn to identify bindweed and guard against its introduction on their farms. Where it has become established, steps should be taken at once for its eradication.

LEARN TO IDENTIFY FIELD BINDWEED

Two kinds of bindweeds occur as common field weeds in Nebraska and since they differ greatly with respect to ease of eradication it is important that one be able to distinguish between them. The most serious and prevalent kind is the field bindweed (*Convolvulus arvensis*). The

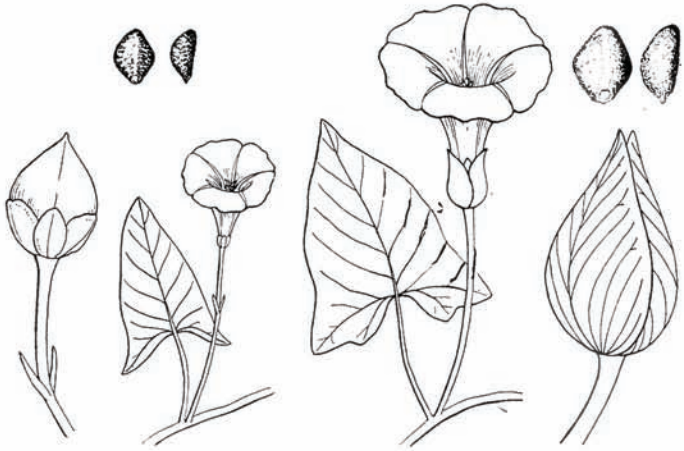

FIG. 1.—Flowers, flower stalks showing bracts, leaves, seed bolls, and seed of the field bindweed (left) and hedge bindweed (right). All parts ½ natural size except the seed bolls and seed which are enlarged 2 diameters.

hedge bindweed (*Convolvulus sepium*) is the only other sort found in cultivated fields of this state, and is far easier to exterminate. These two weeds should not be confused with the common annual morning glory which has large, colored flowers, or with wild buckwheat, a common twining annual weed.

Although there is considerable variation within both bindweed species, the vine, leaves, and flowers of the field bindweed are much smaller than those of the hedge bindweed (Fig. 1). Field bindweed flowers may be pinkish, although white is the prevailing color of both kinds. The shape

of their leaves is quite different. The field bindweed has two very small, narrow bracts or scales on the flower stalk at some distance below the flower, while the hedge bindweed has two corresponding broad bracts immediately at the base of each flower.

Field and hedge bindweeds differ in mode of vegetative spread and overwintering. The field bindweed has a deep root system which lives over from year to year. This may penetrate to a depth of 15 to 20 feet, thus enabling the plant to utilize soil moisture and fertility to a great depth. It has wide-spreading lateral roots which send up numerous stems, and spreads in this way. On the other hand, the hedge bindweed spreads by means of underground, horizontal stems or rhizomes and these are the only parts to survive the winter. These rhizomes must grow both new roots and stems each spring. Owing to the failure of the roots to live through the winter and to smaller food reserves, the hedge bindweed may be more easily exterminated. A single season of thorough fallow may be expected to kill out a well-established patch. The competition from a vigorous stand of alfalfa will often eradicate this species.

The seeds of bindweeds are borne in nearly spherical seed bolls (Fig. 1). When all four seeds develop, they are normally shaped like a quartered sphere. The matured field bindweed seed is about one-third the size of an average wheat grain, brownish-black in color, and slightly roughened or pebbled on the surface. In contrast, the hedge bindweed seed is somewhat smoother and nearly as large as a wheat kernel. The seed of wild buckwheat, with which bindweed is sometimes confused, is similar in size to the field bindweed but has sharp angles, a shiny seedcoat, and a single seed per pod.

PREVALENCE AND SPREAD OF FIELD BINDWEED

Although the field bindweed is known to have been in the United States for at least 150 years, during recent years its spread in many states has been alarmingly rapid. It was first reported in Nebraska in 1888. A recent survey indicates its presence in nearly all counties of Nebraska. In certain areas entire townships have become so badly infested as to be almost completely covered. However, in most of Nebraska, field bindweed is found only in small, scattered patches.

Spread by seed.—The field bindweed is prolific in seed production and when undisturbed ripens seed at about the same time as oats and barley. Threshed seed of such crops grown on infested land may contain many viable bindweed seed. Samples of grain have been examined which contained up to 26,000 bindweed seeds per bushel. Such contaminated grain used as seed is a common source of new infestations. Threshing machines are likely to carry the seed from one farm to another and one should be on the lookout for bindweed patches in the vicinity of old strawstacks. The seeds are also carried by farm wagons, implements, and highway maintaining machinery. Bindweed seed in grain fed to animals may often pass unharmed through the alimentary tract and thus be spread with the manure.

Farmers on land free of bindweed should exercise extreme care in purchasing seed or feed. Before making seed purchases it is wise to submit a representative sample to the State Seed Laboratory, State House, Lincoln, Nebraska, for purity determinations.

Spread by roots.—Root fragments of almost any size have been found to develop new plants readily under favorable moisture conditions. These pieces may start new infestations when scattered by farm or road implements, or when moved with nursery stock.

ERADICATION

Two practical methods are now available for the eradication of bindweeds, namely clean fallow and treatment with sodium chlorate. Either method involves the loss of the use of the land for a period of one to two years. For extensive operations the clean tillage is recommended because of its decidedly lower cost. Sodium chlorate is recommended primarily for cleaning up small patches and inaccessible places along fence rows and highways. Whatever the method used, the roots must be destroyed. Because of the great amount of food reserves stored within them, they must either be killed outright by chemical treatment or starved to death by being repeatedly cut off beneath the soil. By preventing top growth, yet allowing the roots to continue to send up new shoots, a gradual starving of the underground parts is accomplished. The following recommendations are based upon the results of Experiment Station tests and outlying Extension demonstrations.

CLEAN TILLAGE

Duration.—Clean tillage of infested areas for a period of about one and a half to two years usually has been found to eradicate bindweed Two full years of fallow beginning in May of the first year and continuing as necessary throughout the second season, is the recommended practice. If the fallow is started in midsummer immediately after harvest and is continued until the fall of the following year, eradication may sometimes be accomplished and only one crop year will have been lost.

Kind of tillage implements.—It is a good plan to begin the period of fallow by burning excess trash and plowing the land rather deeply. After plowing, the cultivation should be continued with an implement that cuts off all of the plants four or more inches underground. Machines such as the common disk and cultivator are ineffective since many of the plants escape being cut off. Standard implements especially designed and strongly built for summer fallowing are available on the market. One-horse garden cultivators and one- or two-row corn cultivators are often so constructed that they give fairly satisfactory results when equipped with duck-foot or sweep shovels. Since these machines are not as strong as special duck-foot cultivators, they cannot be expected to endure so well the strain of wide duck-foot shovels, except under favorable soil conditions. These shovels must be kept well sharpened and should be of such size as to provide a 3-inch overlap as shown in Figure 2. Improvised farm implements,

equipped with a single, long, horizontal or a V-shaped blade may also be successfully used. A two-row lister has been remodeled in this way and used with satisfaction by the Agricultural College. There is reason to believe that a V-shaped blade will work better and pull with less power than a straight blade.

Frequency and thoroughness of tillage.—Frequent and thorough tillage is essential in eradicating bindweeds by the fallow method. If the clean tillage is started by plowing in the spring when the bindweeds first begin to come up, cultivation at four-inch depths is likely to be required at approximately weekly intervals until growth ceases about October 1. Many of the plants will then survive the winter and renew growth about June 1. Because of a weakened root system the plants will develop more slowly during the second year and the intervals between cultivations may be longer. The plants should ordinarily be dead by about September 1 of the second year. Varying somewhat with soil and climatic conditions, vigor of the plants, and manner of tillage, approximately 16 cultivations the first year and six to eight the second year will be required.

FIG. 2.—View of the duck-foot or sweep cultivator used in the Experiment Station tests, showing the overlapping arrangement of the shovels.

It is better to gauge the time of tillage by the recovery of the weeds rather than by days or weeks. Although five days of growth above ground may be permitted between cultivations without undue restoration of root reserves, it is advisable to cultivate within two or three days after the first weeds appear, because unexpected delays might result in too much recovery.

Crop sequence and follow-up treatment.—After land has been cleaned of field bindweed, it is subject to reinfestation for several years from seed which have lived over in the ground. It is therefore advisable to grow crops which may be thoroughly cultivated, or which occupy the land during a relatively short part of the growing season and permit clean tillage of the land between crops until further danger from seedlings has passed. In any field management which involves keeping the land in fallow much of the time, provisions should be made to guard against excessive erosion.

SODIUM CHLORATE

Description and fire hazard.—Sodium chlorate is the most effective and cheapest chemical known for destroying bindweeds. Because it is cheaper the pure chemical is recommended rather than any mixture with other

salts such as calcium chloride. *One of the disadvantages of sodium chlorate is the fire hazard, and special precautions must be taken to guard against fire. Several persons have been severely burned after allowing a solution of sodium chlorate to penetrate and dry on their clothing. While the clothing is moist there is no danger. Fire injury should be prevented by wearing rubber boots during spray application, and washing these as well as the other clothing immediately after using the chlorate.* Applying the chemical in the dry form eliminates most of the fire danger, if used when the plants are free from dew or other external moisture. The dry chemical should be brushed from the clothing after each treating operation.

Spraying near frame buildings or hay and straw stacks is hazardous and dry treatment is safer. Removing trash and then applying pure sodium chlorate on the bare ground would be safe almost anywhere. Drills and sprayers for applying chlorates should be thoroughly cleaned after use to prevent excessive rusting. Wooden implements which come in contact with chlorate should be kept well painted.

Pure sodium chlorate will not burn. It is dispensed commercially in steel drums and should not be removed from these until used in the field. It may be stored in any farm building without danger, provided none of it becomes scattered about the premises. If one desires to remove a portion from a drum, the container should be taken from the building before it is opened in order to avoid spilling the chemical where a fire might cause serious property loss. Care should be taken to avoid mixing fine organic material such as dust, chaff, and seed with chlorate.

The calcium chloride included in such commercial mixtures as Atlacide absorbs moisture from the air and tends to reduce fire hazard. For this reason such a mixture might be preferred around buildings and along railroads, where there is more danger of fire than in fields. Experiments have indicated that, pound for pound, Atlacide is only about 60 per cent as effective as pure sodium chlorate and proportionately heavier applications are required.

Present prices make chlorate very expensive for application on large fields, especially where land is cheap and the cost of the treatment would be more than the value of the weed-free land. In recent years the price of sodium chlorate has ranged from 8 to 10 cents per pound.

Time of application.—To be effective, chlorate must be in solution within the soil. Favorable soil moisture conditions are more likely to prevail in the fall than during midsummer. Fall treatment in September and October is therefore especially advocated, although spring applications in May and June may be equally destructive in seasons of ample moisture. When applied to a very dry soil, chlorates tend to remain inactive so long as the dry condition continues, which may lead to some loss by decomposition.

Manner of application.—Experiences with spray and dry applications lead to the general conclusion that both are about equally effective. If chlorate is purchased in the form of crystals about the size of a kernel of

wheat, it may be drilled into the soil with an old grain or fertilizer drill. Application by hand seems the most suitable method for small areas. If used as a spray, a solution of from one to three pounds of chlorate to one gallon of water is desirable. The stronger solution saves work and time, but may result in a less uniform distribution of the chlorate. In extensive operations, the solution may be applied by means of a power sprayer although hand sprayers are convenient for small areas and for follow-up treatments.

Amount of chlorate required.—Perhaps the most discouraging feature of chlorate treatments is the impossibility of determining in advance how much chlorate will be required. The amount needed varies with soil fertility, more being required on fertile soil. Soil texture also has an effect;

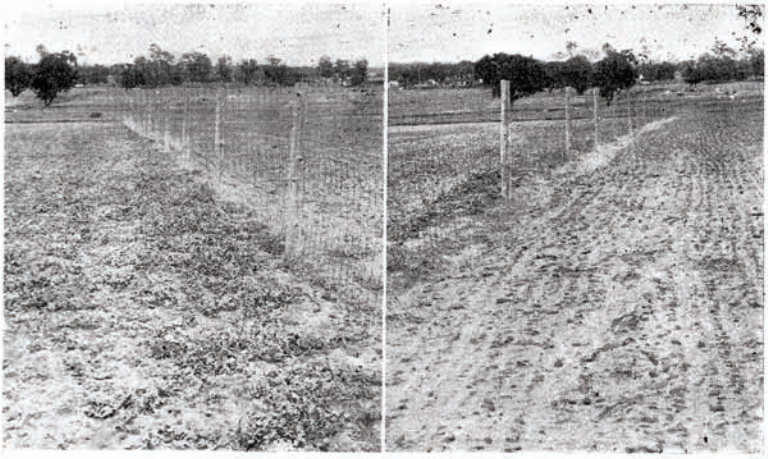

FIG. 3.—Views of adjacent fields which had been cropped similarly to temporary pastures during 15 years. Both fields were heavily infested with field bindweed in the summer of 1932. The field shown at the right was treated with 480 pounds of dry sodium chlorate crystals per acre applied in the fall of 1932 with a grain drill, while that shown at the left remained untreated. With some supplementary chlorate application in spots during 1933 the treated field was essentially rid of bindweeds, while they continued to thrive in the untreated field as may be seen in this figure.

chlorates act more promptly in loose, sandy soil than in heavy soils. This may be due to more rapid penetration of the chlorate but may also be due in part to a difference in root development in such soil. Large, vigorous roots with a large food reserve are much harder to kill than small ones with a scanty supply of stored food.

For average conditions, 2½ to 3 pounds per square rod, or 400 to 480 pounds per acre would be suitable as a first application. This, together with necessary follow-up treatment, is likely to make a total requirement

of 450 to 650 pounds at a cost of $36.00 to $52.00 per acre. Care should be taken to provide for uniform and complete coverage of the infested land.

Follow-up treatments.—Follow-up treatments should be given as the results of the first application indicate they are necessary. Time should be allowed for the first treatment to act before applying more chlorate. Some weeds often persist with a sickly appearance for several weeks or even months after effective treatments, especially if the weather is dry, only to die when rains come later. If the plants show signs of recovery as a result of insufficient application, a second treatment should be given within perhaps a month or two after the first. With late summer or fall application, the follow-up treatment may be given the following season. Delay in follow-up treatments should not be too long, as the weeds may recover after the chlorate has decomposed or has been so dispersed by leaching as to reduce the concentration in the soil. The amount of chlorate required in the follow-up treatment may vary with the number and vigor of the surviving weeds. If only scattered plants or patches remain these may be treated individually. During such intervals when it is difficult to decide from the appearance of the weeds whether retreatment with chlorate would be advisable, supplemental tillage with a plow or sweep cultivator is sometimes recommended to guard against restoration of the roots.

It is best to eradicate bindweeds completely before returning the land to crop production. Cropping systems similar to those described for fallowed land should then be followed in order to avoid reinfestation from soil-borne seeds.

OTHER TREATMENTS

Ordinary salt applied at about one pound per square foot is a very effective treatment. This amounts to approximately 22 tons per acre and is therefore very expensive. Salt damages the soil far more than do the chlorates. Carbon bisulphide is expensive and does not work in all kinds of soil. The labor of applying is also excessive. Arsenical compounds are expensive, uncertain in their action, and a menace to livestock.

Attempts to destroy small patches of bindweeds by intensive hogging down, and by covering with tar paper, or with deep straw or manure may sometimes be successful but such treatments are seldom practical and are not recommended. Neither smother crops such as alfalfa, cane, sudan grass, and tall-growing weeds, nor grazing by cattle or sheep have been found to successfully eradicate bindweeds though they may serve to check somewhat their damage and further spread.

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