Weeds of corn fields.

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WEEDS OF CORN FIELDS.

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BULL THISTLE (*Cnicus lanceolatus*). From a photograph by W. Newell.
WEEDS OF CORN FIELDS.

BY L. H. PAMMEL.

Of the cereals, the corn crop is the most important in Iowa. The acreage devoted to this crop in 1897, according to Mr. Sage, amounted to 8,043,390. The average yield was 39 bushels per acre; total product, 313,692,210 bushels, having a market value of $43,916,904. Oats rank second, there having been 5,825,000 acres with a total yield of 73,450,000 bushels, having a market value of $8,814,000. Wheat ranks third, with a total acreage of 751,708, total yield 10,398,785 bushels, with a value of $6,027,853.

While weeds are troublesome in fields where small grain is sown, especially weeds like the Russian thistle, which are a menace at harvest time, there are others which are chiefly troublesome because they rob the soil of some of the needful food elements, and by obstructing the light, prevent the plant from making the greatest amount of food, and hence the crop is lessened. The great ragweed and mustard belong to this class. Other weeds, like germander, while not so tall, are of injury to the growing crop because of the network of "roots" (rhizomes) that are produced underneath the soil and prevent the full development of the roots of the grain crop. In case of the small cereals something of a crop may be obtained even though the weeds are numerous. Corn is pre-eminently a cultivated crop. The plants require attention from the time the seed is put in till the plant is "laid by." Unless it receives this attention the crop will be absolutely worthless as a cereal. An acre of corn requires, therefore, vastly more care than an acre of wheat. It is not, therefore, a small matter to the farmers of Iowa to take care of the 8,043,390 acres of corn. Corn is cultivated not only to remove the weeds but also to preserve the moisture, and this is quite as important as to remove the weeds.

A weed, in the ordinary acceptance of the term, is a plant growing where it is not wanted. All plants, except corn and the accompanying crop, pumpkins, must be considered as weeds.

CLASSIFICATION OF WEEDS, ORIGIN AND DURATION.

For the sake of convenience, so far as distribution is concerned, we may class the weeds of cornfields as follows: European, Southern, Northern, and Western; or we may class them as annual, biennial, and perennial. It is not our purpose to enumerate all of the weeds, but those most troublesome.

European Weeds.—These are natives of Europe, and for the most part have been established here for a long time. Some, like the prickly lettuce

1Annual report of the Iowa Weather and Crop Service, 1897: 28.
(Lactuca Scariola L.), are of more recent introduction. Pigeon grass and foxtail are natives of Europe, and have been established a long time. These are generally distributed throughout the state. The bull thistle is occasionally seen on the borders of fields; this is also a native of Europe, and of universal distribution in the state. The European bindweed (Convolvulus arvensis) has become established locally in several places, quite recently.

Southern Weeds.—These are most common in southern parts of the state; as an illustration, the cocklebur (Xanthium canadense) may be mentioned; it also has a wider distribution. The Indian mallow (Abutilon Avicenneae) comes to us from the south and is spreading northward very rapidly. The horse nettle (Solanum carolinense), an extremely common weed in Missouri, is becoming plentiful in southern Iowa, and spreading northward; it is becoming well acclimated at numerous points in the state.

Western Weeds.—The most conspicuous of the western weeds is the buffalo bur (Solanum rostratum), which has been reported to us from widely separated localities in the state. Cream weed (Lygodesmia juncea), a common composite plant of the western states, has become locally common in northwestern Iowa.

Northern Weeds.—As a distinct northern weed, marsh elder (Iva xanthifolia) may be given. This has spread southward along the Missouri, and thence northeastward across the state. Several of our smartweeds are northern, as the marsh smartweed (Polygonum Muhlenbergii).

DURATION OF WEEDS.

Annual Weeds.—The seeds of annual weeds germinate in the spring, produce flowers and seeds the same season, and this ends their existence. Foxtail (Setaria viridis), ragweed (Ambrosias trifida), smartweed (Polygonum pennsylvanicum) are illustrations. These produce an abundance of seed. The annual class varies greatly; some of the annuals approach the biennials, and are known as winter annuals. Seeds of these germinate in the fall, produce a good growth of radical leaves, live through the winter, and, if the season happens to be a favorable one, may grow during mild weather; on the appearance of warm weather in the spring, these plants grow rapidly, some flower and produce seed, and then die. Prickly lettuce, squirrel-tail grass, all most noxious weeds, belong to the class of winter annuals. The annuals differ in regard to their pertinacity. Shepherd’s purse is easily subdued; crab grass is not so easily destroyed, since it strikes root so easily at the nodes; foxtails are easily subdued as individuals, but the chief difficulty is that these plants seed so abundantly that the soil contains myriads of seed, a large number of which are ready to take the place of those that have been destroyed. Some of these winter annuals, like the prickly lettuce, when cut off above the surface of the ground, send up a number of branches; these flower in a short time, and where there was only a single stock before there may now be a dozen.

Biennial Weeds.—These are not conspicuous in cornfields for the reason that the young plants are destroyed in cultivation. Biennial plants produce only vegetative organs the first season, in many of these a rosette of leaves spreads over the ground; the second season a flower stem is thrown up. This bears flowers and seeds. As an illustration, bull thistle (Cnicus
Ragweed (Ambrosia trifida), border of fence row. From a photograph by W. Newell.
lanceolatus). Mullein, burdock, parsnip and carrot are other illustrations. The biennial weeds are conspicuous examples in fields that are poorly plowed. These are likely to crop out in cornfields where the plan is adopted to run through with a cultivator. Biennial weeds will not appear where the ground is properly plowed. Nevertheless, these weeds may appear on the borders of the field and fence corners. We have here a most conspicuous example in the bull thistle.

Perennial Weeds.—These weeds live for considerable time. The plant produces underground stems. These send up stalks and in turn produce flower and seed. When cut off new flowering stems are produced. The weeds of this class cannot be removed by simply cutting off the stems below the ground. As an illustration of this class, morning-glory (Convolvulus sepium), milk weed (Asclepias cornutif) and horse nettle (Solanum carolinense) may be cited. The weeds of this class do not depend for their existence on seed production, as is evidenced by the horseradish, which has continued to propagate in this country without seeds. Other weeds of this class are largely extended by their root propagation. Indeed, as a general thing, many of the most troublesome weeds of this class are not so seed productive.

MOST TROUBLESOME WEEDS.

An examination and an extended study of cornfields of Iowa convinces me that the most troublesome weeds are the foxtails (Setaria viridis and S.

Fig. 1. Green Foxtail (Setaria viridis), showing "seed" and bristle.
Fig. 2. Pigeon grass (Setaria glauca), showing "seed" with cross striations and bristles.
Fig. 3. Bristly Foxtail (Setaria verticillata), showing "seed" with barbed bristle.
Fig. 4. Crab grass (Panicum sanguinale), showing seed with attached glumes.
Fig. 5. Barnyard grass (Panicum crus-galli), "seed" and long awned flowering glume.
Locally the bindweed or morning-glory (*Convolvulus sepium*) causes considerable trouble. Other weeds, like northern nut grass (*Cyperus esculentus*) causes much trouble early in the season. In wet soils the purple smartweed (*Polygonum Muhlenbergii*) is troublesome. But of all the weeds none cost the farmer of Iowa so much labor as foxtails.

It is not an easy matter to discuss the question of the most troublesome weeds. Speaking of this Mr. Selby says, "Lists of 'worst,' 'bad' and 'indifferent' weeds are of great interest, yet the plants in a list of 'worst' weeds cannot usually claim a large range. Sorrel is the worst weed upon the station farm when a period of years is considered." Halsted, who investigated the question for the entire United States, gives us a most instructive table for the states of Iowa and New Jersey:

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*SmarTWEB (Polygonum pensylvanicum).* From a photograph by W. Newell.

IOWA.

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<td>51</td>
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<td>12</td>
<td>48</td>
<td>94</td>
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<td>Indifferent weeds</td>
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<td>9</td>
<td>121</td>
<td>152</td>
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NEW JERSEY.

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<td>7</td>
<td>17</td>
<td>54</td>
</tr>
<tr>
<td>Bad weeds</td>
<td>44</td>
<td>15</td>
<td>39</td>
<td>98</td>
</tr>
<tr>
<td>Indifferent weeds</td>
<td>31</td>
<td>12</td>
<td>70</td>
<td>113</td>
</tr>
<tr>
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<td><strong>105</strong></td>
<td><strong>34</strong></td>
<td><strong>126</strong></td>
<td><strong>265</strong></td>
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Hitchcock, speaking for Kansas, says: "To the first group belong the most troublesome weeds, such as cocklebur, sandbur and purslane. They are chiefly annuals and are frequently species introduced from Europe. There are among them, however, several perennials, as the bindweed and the ox-eye daisy, and several that are native of Kansas."

DESCRIPTION OF THE MOST CONSPICUOUS WEEDS.

**Green Foxtail, Bottle Grass or Pigeon Grass (Setaria viridis Beauv.).**—This European annual grass is now extensively naturalized in all settled parts of the United States, as well as Australia. The spike is quite compact with numerous spikelets, with bristles longer than the spikelet. The bristles are green. The heads or spikes vary from one to three inches long, and in some specimens five and six inches long. The seeds are slightly pitted and very minutely cross-striated. A single head produces an enormous number of seeds. These seeds appear to have considerable vitality. Cultivated ground is thickly seeded, hence it is almost impossible to remove the weed. When fields are sown to oats this plant comes up in the fall and late summer, seeding the soil.

**Foxtail or Pigeon Grass (Setaria glauca Beauv.).**—This grass is also very abundant, though less common than the former. The heads are more slender and the bristles tawny yellow. The small seed of this species are conspicuously cross-striated and are easily distinguished from the last species because of its larger size and by its cross striations. This species also comes up in grain fields after harvest, hence seeding the soil abundantly. Both of these species are much more tenacious when young than

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when older. The ground is covered so thickly that only some of the plants are destroyed. Covering up with soil is effective as well as exposing the roots to the sun.

*Bristly Foxtail (Setaria verticillata Beauv.).*—Bristly foxtail is an annual. It has become quite troublesome in some of the southern states. Recently it has been found in the southeastern part of this state as well as southwest Iowa. As yet it is not specially troublesome in fields but in course of time will no doubt be as injurious as the other species considered. This species differs from the others considered here in that the bristles are short, single or in pairs, roughened or downwardly barbed. The seeds are small, greenish, one-eighth of a line long, minutely cross-striated and wrinkled.
FINGER-GRASS.

Crab-Grass or Finger-Grass (*Panicum sanguinale* L.).—This weed is easily recognized by the erect or spreading culms. The latter “strike root” at the nodes. The grass is one to two feet high. Flowers produced in digitate spikes, hence the common name finger-grass. The so-called flowers are borne in spikelets, consisting of two sterile glumes and the flower proper which consists of a flowering glume and the palet both remaining attached to the so-called seed. The seed is minutely pitted and cross-striated, of a light straw color except where the sterile glumes remain attached. These are gray in color and minutely hairy. It is much more difficult to remove this grass than the foxtails. It produces an enormous number of seeds. Finger grass is a native of Europe but is extensively naturalized in the United States.

Barn-yard Grass (*Panicum crus-galli* L.).—This coarse annual grass is abundant in many fields. Culms branch from the base, one to four feet high, with wide leaves; spikes one to three inches long crowded in a dense panicle. The flowers in this species are arranged in much the same way as in crab-grass, the spikelets consisting of two flowers; the lower flower is sterile and consists of flowering glume and palet. The upper flower is perfect. The flowering glume usually has a long pointed awn; this, however, is somewhat variable. The perfect flower is coriaceous, shining gray, distinctively nerved, two lines long, one side is convex, the other flattened.

Smartweed (*Polygonum pennsylvanicum* L.).—An annual; one to two feet high, with lanceolate leaves. The branches below the flowers are beset with numerous stalked glands; flowers whitish or rose colored; stamens, six to eight style two cleft; the fruit is an achenium, popularly called the seed, one and three-fourths lines long. It is flattened, brown, shining, part of the calyx remaining attached to the base. Cornfields are sometimes covered with it, though, when cultivation is thorough, this weed need occasion little alarm. A closely related species, *P. lapathifolium* L., var. *incarnatum* Watson, is much taller, has longer spikes and smaller flowers, and is without the glands. This species is common in low grounds, especially so in northern Iowa.

Marsh Smartweed (*Polygonum Muhlenbergii* Watson).—Marsh smartweed is extremely common in low grounds, especially in old lake beds and ponds. These ponds, when drained and planted to corn, grow up with this weed. It is from one to three feet high, with long, underground, brownish-black rhizomes; flowers, bright rose color, in long spikes, one to three inches long; seeds blackish. This weed has frequently been received by us for identification, with the statement that it was difficult to remove. It is common from New England across the continent. In fields once thoroughly drained and cultivated, this smartweed is not a serious enemy to corn culture.
Northern Nut Grass (*Cyperus esculentus* L.).—This grass-like plant grows from one to two and a half feet high, has triangular stems, leafy at the base when young; later the leaves terminate the stems.

The spikes consist of numerous spikelets. These have from twelve to thirty flowers, light chestnut or straw colored. The scales of the spikelets are rough margined; achene (seed) longer than broad.

This perennial weed spreads extensively by its underground, nut-like tubers, as shown in figure. It is closely related to the southern nut grass (*Cyperus rotundus* L.), and in the north entirely replaces it. In Iowa *Cyperus esculentus* is quite universally distributed. It has been observed and noted in Iowa as follows. In part represented by specimens in the college herbarium and in part based on notes furnished me by R. I. Cratty, of Armstrong, Iowa: *Cyperus esculentus* L., cosmopolitan; in North America ranging from New Brunswick to Florida and west to California and Texas. Iowa, central, southern and eastern portions of the state; Iowa City and Ames, 1886. Hitchcock; Marshalltown, 1881, Stewart; Fayette county, 1893.
NORTHERN NUT GRASS (Cyperus esculentus), achenes of achenium "seed") in spike; $s$, stamens; $a$, acheni

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Fink; Clinton county, 1896, Pammel; Clayton county, 1895, Fitzpatrick; Scott and Muscatine counties, where it is quite frequent in cultivated fields, Barnes and Miller. It is more abundant in low grounds; especially common about Clinton, Des Moines, Ames and Missouri Valley. Professor Henry* of the University of Wisconsin, some years ago, made inquiries in regard to weeds in that state. This weed was sent to him frequently. This sedge is most troublesome in early spring. The fields where it is common have a yellow color.

**Marsh Elder (Iva xanthiifolia, Nutt).**—An annual weed one to seven feet tall, leaves all opposite, hoary, with minute down, ovate rhombic or the lowest heart-shaped, doubly serrate or cut-toothed or obscurely lobed; heads small, crowded in axillary and terminal panicles.

In Gray's manual, sixth edition, the distribution of this weed is given as follows: Northwest Wisconsin to Minnesota and Kansas, westward. It must indeed have originally been quite local in many places in this region. It is only recently that this weed has attracted attention. The weed has been known in southwestern Minnesota, near LaCrescent, since 1881, where it occurred as an introduced plant along the embankments of the roads. Strange to say, this weed did not occur on the east side of the Mississippi river as late as 1897 at that point. In 1889 and 1890, this weed was growing in considerable quantity in a few places in the city of Boone, Iowa. The weed has made little progress east of Boone. Ames is but fourteen miles distant, as yet the weed has not been found in this city. West of Boone, especially at Woodbine, in Harrison county and in Crawford county, it is very common. In Monona county it occupies many of the vacant lots. It has also been observed in Cerro Gordo, Kossuth and Emmet counties. J. C. Arthur writes that he observed it in Charles City, Floyd county, in 1871. This county joins Cerro Gordo on the east. The species has also been received from Fremont county, in southwestern Iowa. It is common in the Red River valley of the north and other parts of Minnesota and Dakota, and in parts of Iowa along the Missouri river, as well as in Colorado. It is a very aggressive weed as accounts by Upham, Bolley, Crandall and Bush indicate. At Missouri valley, as far north as Onawa in the Missouri river bottoms, this weed occurs in abundance, occupying waste places, streets and yards around neglected buildings, so much so that it may be fairly called a nuisance. It is seldom, however, that this weed gives the farmer much trouble, as it may be eradicated very easily. The weed reminds one very much of the great ragweed of the Mississippi valley.

Marsh elder was originally native from northwest Wisconsin to New Mexico, as Fendler collected it in the later place as early as 1847, but since the cultivation of the prairies it has become much more common. It was undoubtedly confined to alluvial soils, and from thence spread to neighboring farms, especially near barns and neglected buildings.

In regard to the distribution, Conway McMillan* says:

"Minnesota valley throughout, especially south central and southwest districts, roadsides, banks and waste places."

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7 Metaspermacae of the Minnesota valley, 533.
**Great Ragweed (Ambrosia trifida).** Staminate flowers above, pistillate below; **b**, achenium ("seed"); **a**, bracts surrounding achenium. Used by permission U. S. Department of Agriculture.
Iowa.—In western Iowa, extremely abundant, occupying waste places, in streets, near neglected buildings, a tall coarse and homely weed, in many cases eight to ten feet high.8

Ragweeds.—Two ragweeds are common in all parts of Iowa. The greater ragweed (Ambrosia trifida L.) and the smaller ragweed (A. artemisiaefolia L.).

The great ragweed (Ambrosia trifida L.) is a conspicuous object along roadsides and fence corners. The stem is stout, three to twelve feet high; leaves large, the lobes ovate-lanceolate and serrate; petioles margined,

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flowers monoecious, the staminate flowers borne in spikes terminating the stem, fertile flowers borne in lower portion of spikes surrounded by larger bracts. What is ordinarily called the seed is an involucre. This is surmounted by several tubercles enclosing a single oily seed (achenium).

The ragweeds are mostly annuals, come up in early spring, make a rapid growth, flower in August and September, and produce an enormous quantity of seed. They are readily destroyed, but the seed undoubtedly retains its vitality for some time. "I remember well on my father's farm in Wisconsin that, although the rich soil had been in meadow for some time ragweed would appear in some places when sown in wheat. The seed was to

DISTRIBUTION OF RAGWEEDS IN IOWA. UPPER FIGURE GREAT RAGWEED.
some extent carried by the drifting snow in winter, others perhaps retaining their vitality. In driving through the country or riding in cars, nothing is more unsightly than this ragweed, which is allowed to grow everywhere. Nothing is done to check its growth. In some cases enough is cut off to allow vehicles to pass with ease, but along the fences this mighty weed grows seven or eight feet high."

This weed occurs most commonly along fences adjacent to cornfields. Although coming up abundantly in cornfields in the spring, it is easily destroyed.

Small ragweed or bitter weed (Ambrosia artemisiifolia L.). This is a much branched annual, one to three feet high, hairy and roughish, pubescent, leaves once or twice pinnatifid. Flowers monoecious; staminate above the pistillate, the latter in lower part of spike. Seed obovoid or globular, armed with short teeth or spines. The smaller ragweed also occurs on the borders of cornfields. Although abundant sometimes in the early spring it is easily destroyed.

Thistles.—The term thistle is frequently applied to any spiny plant. Thus it has become customary to call the buffalo bur the spiny amaranth, and the Russian thistle by this name, but these are not related to plants here considered. The common thistles are all members of the composite family, and in some instances are known as very noxious weeds. At least three are quite common in the state of Iowa, the bull thistle, or lance-leaved thistle, prairie thistle and Canada thistle.

Bull Thistle (Cnicus lanceolatus Hoffm.).—This is common in many parts of eastern United States, especially in the north. A native of Europe, though less frequently mentioned there as a trouble some weed than the Canada thistle, probably because it is easier to exterminate.

A fairly good idea of the noxious character of this weed may be obtained from the accompanying cut which shows a hedge of these on the edge of a farm field, close to a fence. This weed is, however, most conspicuous in fields that are pastured.

Formerly Iowa had a law which required the removal of this species, but the legislature, in codifying the laws, omitted this species, so that only two weeds—Canada thistle and Russian thistle—remain on our statutes.

Bull thistle is a biennial, from two to four feet high, bushy in habit. The main stem produces numerous branches, leaves about six inches long, the lobes producing sharp, spiny bristles. The leaves run down along the stem and are attached without a stalk or petiole. The head, commonly called the flower, is surrounded with a large number of small leaves or bracts, each ending in a spine. The heads are about one and one-half inches high. The flowers are pale red or purple. The "seed" (a fruit known as an achenium) has coming from its apex numerous plumose bristles, known as the pappus. The pappus enables the wind to carry the seed. Bull thistle is usually found in open woodlands, pastures, and along roadsides, especially in burnt forests around ash piles. It only lives two years. The seed germinates in the spring, and a spreading plant with very spiny leaves is produced the first season. The second season it sends up numerous branches; these bear flowers and produce the seed. It is an easy matter to kill this thistle. Cut off the young seedlings with a hoe in the spring, and none will produce seeds.
Bull Thistle (*Cnicus lanceolatus*); 1, head; 2, flower; 3, "seed" with pappus; 4, single plume of pappus.

The distribution of this species in this state represented by specimens in collection is as follows: Keokuk, Macksburg, Decatur county, Boone, Ford, Ruthven, Dixon, Grinnell, Hawthorne, Creston, Audubon, Exira, Washta, Barnes City, Glendon, Clarkson, Sac City, Ames.

Prairie Thistle.—This is a closely related species and known botanically as *Cnicus altissimus* Willd., variety *discolor* A. Gray.

The species is native and occurs in many parts of eastern United States, especially common throughout the Mississippi valley. It is frequently called bull thistle, but incorrectly. In Missouri, Wisconsin and Illinois it is very abundant. It is also common and more troublesome over the greater part of Iowa than the bull thistle. Like the latter it is biennial, bushy in its habits, frequently six feet high. The leaves are less spiny, as are also the small leaves surrounding the "flower." The leaves are not prolonged down the stem, and are white and woolly underneath. The
1. General aspect of plant. 2. Rootstock. 3. Flower and "seed."

Cut kindly loaned by Wallaces' Farmer from U.S. Dept. of Agriculture.
Upper figure of Prairie Thistle (*Cnicus altissimus* var. *discolor*), based on observations.

Lower figure Bull Thistle.

Leaves (bracts) surrounding the flower are gummy and often catch insects. The gummy character easily distinguishes it from bull thistle.

Distribution of prairie thistle according to specimens in college collection is as follows: Ames, Muscatine, Newton, Boone, Cedar Rapids, Winterset.

*Canada Thistle* (*Cnicus arvensis* Hoffm.).—In many parts of the United States, especially in the eastern and middle states, it is a most troublesome weed. Darlington, in his "American Weeds and Useful Plants," says: "This is, perhaps, the most execrable weed that has yet invaded the farms of our country." The Canada thistle is in every respect a smaller plant...
than either of the species described above. It is usually from two to three feet high, is leafy, with numerous branches. The leaves are from three to six inches long, with several prominent lobes. The leaves bear sharp, stiff bristles. The leaves are not prolonged down the stem. The heads (flowers) are about half the size of the bull thistle. The small leaves (bracts) which surround the "flower" are smooth and, for the most part, without prickly points. The other thistles mentioned above have perfect flowers, but in this species they are dioecious, that is, one plant produces male or staminate flowers, while another female or pistillate. The Canada thistle differs
from the others in another and important particular. It has creeping underground stems, every one of which, when severed from the plant, develops into a thistle if the conditions for growth are present. The character of the "root" and plant is shown in figure. I have on several occasions made the statement that Canada thistle does not seed in Iowa and generally in the west. Farmers have made very positive assertions that it does. But whenever such cases have been examined the seed has not been found. I have repeatedly examined the thistle in Wisconsin, Iowa, Illinois and Missouri, and with few exceptions seeds have not been found. It is a well known fact that Canada thistle occurs in great quantities in and about Chicago, especially west and north. Some years ago I examined a large number and only once did I find seeds in one of the heads.

The weed is common in and about Milwaukee, and there I found seed in abundance. It occurred to me that possibly the seed would not germinate. This proved not to be the case. When placed in the soil the seed germinated very readily. The question naturally arises, why does it not seed in the west? soil and climate seem to be adapted to it. An explanation may be found, I believe, in the character of the flowers, which, as stated before, have the sexes separated. I believe very often only one sex is introduced. It is often introduced with packing of various kinds. I recall several cases. One in St. Louis, where the weed made its appearance in a vacant lot, which had been used to heel in trees. A similar instance is recalled for Ames. Any one familiar with this weed in Iowa knows that there is a common starting point, and from this it spreads in all directions. The Canada thistle is quite as bad a pest in Europe as in this country.

Numerous suggestions have been made in regard to stamping it out. In Germany and in this country experiments have been made to crowd it out with leguminous plants. Professor Beal recommends red clover, while in Germany alfalfa has been largely used. I think the weed can be kept

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1. Taylor Co.  
2. Chickasaw Co.  
3. Muscatine.  
4. Des Moines.  
5. Marshalltown.  
6. Iowa City.  
7. Johnson Co.  
8. Marcus.  
10. Randall.  
11. Winterset.  
12. Ladora.  
15. Charles City.  
17. Cresco.  
18. Sac City.  
19. Oelwein.  
20. Griswold.  
22. Bancroft.  
23. Lawler.  

**Distribution of Canada Thistle in State.**

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down and killed, if the work of cutting down and removing all of the "roots" as far as it is possible to do so, if done frequently and thoroughly the weed can be removed. If the patch is a small one, cutting off the parts as soon as they appear above the ground several times during the season will certainly destroy it. In large patches plow the ground, harrow and remove the thistle, either burn the material or put in compost heaps. This should be done five or six times during the season or as occasion may require.

Dr. Halsted suggests the following: "Cut the thistles before flowering, plow the ground, grow a crop of Hungarian grass, which is either cut for hay or plowed under, follow by winter rye, which is also treated as the Hungarian grass, and the land put into hoed crops for two or more years." Professor Goff, who has given the subject of Canada thistle some attention, quotes from a valuable paper by Ambrose Stevens on this subject. Mr. Stevens reports the following experiment. Three kinds of soils were experimented with:

First.—A strong clay loam with some slate intermixed.
Second.—A reclaimed swamp with a shallow upper soil of vegetable mould, alluvial deposit, and clay resting on hardpan.
Third.—A rich, alluvial creek bottom.

The first was plowed nine inches deep in April, and repeated monthly till September, when wheat was sown. Thistles did not appear after the third plowing. The season was a dry one.

On the second soil three plans were tried:
(a) A plat was burned over by firing logs till the upper soil was heated through to the hardpan.
(b) Was burned over like the first, and thoroughly salted.
(c) A plat was soaked down to the hardpan with strong brine.

The thistles were completely destroyed in all cases.

On the third soil the roots penetrated three feet. A plat was plowed six times from April to August. In September the thistles were as vigorous as ever. The next year it was planted with corn. It was plowed and hoed until September. Again in October the thistles were very vigorous. A second plat was burned over with log heaps; in a month the thistles were up. A third plat was burned over, and in addition salted three times; in a month thistles flourished again. The next year the three plats were sown with red-top grass, and where the grass became established the thistles were choked out.

These experiments show that the character of the soil has much to do in destroying Canada thistles. Kerosene oil, oil of vitriol, and other chemical substances will prove effectual. But in using oil of vitriol, it should be remembered that the soil will be rendered more or less worthless. All of these substances should be used only on small patches.

Sunflowers (*Helianthus annuus* L.).—The common sunflower (*Helianthus annuus* L.) is a tall, rough annual, six to eight feet high, with three ribbed ovate or lower cordate leaves; serrate, large heads, with large, yellow ray flowers, disk flowers of dark color. Common sunflower, although common in central and northern Iowa, is not usually troublesome. In western Iowa, especially in the Missouri river bottom, it is much more abundant, and the tall plants are conspicuous. This weed, although occurring wild
from Minnesota to Texas, is more abundant from Kansas to Texas. It has spread into Iowa from the southwest. Sunflowers can be destroyed easily by good cultivation.

Another sunflower (*Helianthus gross-serratus* Martens) is common throughout the state. This perennial species has much smaller flowers (heads). It is most common on the borders of fields, along fences and grassy
banks. It is the most conspicuous of all our sunflowers. It is easily subdued by thorough cultivation, although it may reappear again.

The related *H. Maximiliani* Schrad., is one of the most common species in western and northern Iowa. It requires the same kind of treatment.

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**Fig. 14.** Bull Thistle (*Cnicus lanceolatus*), "seed"; achenium with some of its plumose bristles.

**Fig. 15.** Prairie Thistle (*Cnicus altissimus var. discolor*), "seed"; achenium with some of its plumose bristles.

**Fig. 16.** Canada Thistle (*Cnicus arvensis*), "seed"; achenium with its plumose bristles.

**Fig. 17.** Common Sunflower (*Helianthus annuus*), "seed"; achenium with chaff removed.

**Fig. 18.** Meadow Sunflower (*Helianthus grosse-serratus*), "seed"; achenium with its chaff at upper end.

**Fig. 19.** Hairy Sunflower (*Helianthus Maximiliani*), "seed"; achenium with chaff.

**GENERAL TREATMENT OF CORN FIELDS.**

In regard to the early eradication of weeds, Mr. John Cownie says in the *Iowa Homestead*:* "The harrow should follow the planter closely for, in addition to stirring the soil and eradicating any weeds that may have started, in case of a heavy rainfall, washing on rolling ground is in a large

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measure prevented. But, while I have for many years practiced harrowing lengthwise and then crosswise of the rows, as the planter was driven, until the corn begins to make its appearance, I now have serious doubts in my mind in regard to the benefits of such indiscriminate harrowing after planting. Every farmer is familiar with the appearance of even the best cornfields during the season of cultivation, and has noticed that there are always hills more or less smaller and weaker than the others. In heavy soil and wet weather, shallow cultivation is a mere waste of time and labor, while deep and thorough stirring of the soil, leaving the surface between the rows somewhat rough, destroys weeds and assists in the evaporation of the surplus moisture; and in addition deep cultivation allows the air to permeate the soil, to warm it and to assist in forcing growth. But with light soil and during dry weather, surface cultivation will destroy weeds very effectively, for growth is then slow and greatly retarded and the object should be to conserve moisture, and this is best accomplished by thorough and repeated stirring of the surface soil, leaving it as fine and smooth as possible."

It is very important that soil used for corn should be in good shape. Above all it is essential that the land be prepared as far as possible in the fall. This cannot be done unless the farmers of this state practice rotation of crops more generally. To a considerable extent farmers do practice rotation, but the area devoted to corn culture is far in excess of that devoted to cereal, clover and timothy culture. The cereal fields and clover and timothy meadows should be turned over sufficiently early in the fall to permit the germination of a large number of weed seeds, notably the annuals. Clover and timothy meadows will be found far cleaner than the cereal fields, for the reason that these plants will smother a large number of the annuals because of the exclusion of light. Some, however, still persist, and when the ground is well prepared the seeds of many of these will germinate, and on the approach of frost the young plants are destroyed. Perennial weeds are not so easily destroyed in a meadow by suffocation. I refer to such weeds as dock, horse nettle, milkweed and bindweed (Convolvulus arvensis), and the common Morning-glory (Convolvulus sepium). These weeds need a special kind of treatment. Another class of weeds, represented by shepherd's purse, prickly lettuce, squirrel-tail grass or wild barley, are winter annuals, and hence the plowing of fields in the fall and germination of the seed of these plants gives them a favorable opportunity for growth and extension. Two of these weeds have become especially common in our meadows, namely, the prickly lettuce and wild barley. To properly treat these, it is essential that soil which is to be used for corn the next season should have these weeds removed early in the season, so that seeds will not be produced. However, should any of these still remain, the field should be harrowed in the fall, so as to destroy the young plants. The weeds, so far as treatment is concerned, then naturally fall into four classes—the annuals, perennials, biennials and winter annuals. The winter annuals have been discussed sufficiently above, and will not, therefore, need further discussion.

ANNUAL WEEDS.

Of the annual weeds treated in this paper the foxtails are difficult to remove, largely because of their seed productiveness. The individual
plants are readily destroyed by pulling up; or running through with a cultivator, or a harrow, is effective; or covering up with dirt will suffice to destroy the young plants. The fact, however, that these weeds are permitted to come up along roadsides, and are abundant in fields and meadows and along the borders of fields makes it entirely impossible to banish these from our soil. As said before, the proper thing to do is to induce germination in the fall, and if the field is properly prepared the first warm weather in the spring will induce a large number of additional seeds to germinate. These plants may then be destroyed by harrowing before the corn is planted. After the corn is planted, cultivation should begin as soon as possible.

Finger grass should receive the same general treatment. It comes up later in the season and is somewhat more difficult to destroy because it so readily takes root at the nodes. Cultivation needs to be more thorough.

Barnyard grass and smartweeds can be treated in the same general way. The common sunflower is easily subdued by similar methods. The marsh elder needs a line of treatment similar to that used for ragweed.

Ragweeds.—These are easily destroyed in their early condition. The young plants may easily be recognized by a pair of somewhat large, fleshy, roundish seed leaves. The harrow in running over the fields is sure to destroy 75 per cent of these young plants, and the cultivator will take the remainder when they are accessible. On the borders or edges of fields these weeds should be cut down when they are from six inches to a foot high. This is easily done with a mower and a scythe. The seeds have considerable vitality and may show evidence of coming up in waste places and fields for several seasons. If so, the same process should be repeated, if so treated the weed need occasion no alarm, and the facts are that many farmers are neglectful of their duties. This neglect is especially observed with reference to our roadsides. Many of the road overseers are remiss in their duties, for the laws of Iowa state:

"SEC. 696. Prevention of Nuisances.—To provide for the destruction of weeds and other noxious growths upon any of the lots therein.

"SEC. 1533. Duty of Trustees.—It shall cause both the property and poll road tax to be equitably and judiciously expended for road purposes in the entire district; shall cause at least 75 per cent of the township road tax to be thus expended by the 15th day of July in each year; shall cause the noxious weeds growing in the roads to be cut twice a year, when necessary, and at such times as to prevent their seeding, and it may allow any land owner a reasonable compensation for the destruction thereof, when growing in the roads abutting upon his land, and credit him therefor on his road tax for that year.

"SEC. 1562. Canada Thistle.—The road supervisor, when notified in writing that any Canada thistles or any other variety of thistles are growing upon any lands or lots within his district, vacant or owned by nonresidents, the owner, agent or lessee of which is unknown, shall cause the same to be destroyed, and make return in writing to the board of supervisors of his county, with a bill for his expenses or charges therefor, which in no case shall exceed $2 per day for such services, which shall be audited and allowed by said board, and paid from the county fund, and the amount so paid shall be entered up, and levied against the lands or lots on which said
thistles have been destroyed, and collected by the county treasurer the
same as other taxes, and returned to the county fund."

Is it anything to be wondered at that sweet clover, ragweed, and other
weeds mentioned in this paper should be so abundant when nothing is done
to prevent their growth along the roadside?

BIENNIAL WEEDS.

In biennial weeds it is important to destroy the plants the first season.
In the case of the bull thistle and common prairie thistle, all of the spread­
ing young plants of the first season should be cut off close to the ground.
This can be done with a hoe, or any other instrument that will easily cut
the tap root off.

PERENNIAL WEEDS.

Many weeds require specific treatment, but the following general rules
may be observed: If the patch is a large one, the ground should be plowed
and the "roots" (rootstocks) exposed to the action of the sun. Thorough
cultivation should be repeated as often as there are any signs of weeds.
The plant should not be permitted to grow green leaves. It must be
starved. This will in time destroy the weeds, but too often the cultivator
tires before the weeds do. If the weeds are widely scattered and the roots
are vertical as in the milkweed and horse nettle, the spud can be used to
advantage. In the case of the horse nettle, these "roots" often extend
two or three feet down into the ground, so that the most efficacious way is
to starve such plants. In the case of dock, a twist and a jerk will enable
one to pull it up in moist weather.

Dewey* makes the following suggestions:

1. The rootstocks may be dug up and removed, a remedy that can be
applied practically only in small areas.

2. Salt, coal oil, or strong acid applied so as to come in contact with the
fleshy cut roots or rootstocks, destroys them for some distance from the
point of contact. Crude sulphuric acid is probably the most effective of
comparatively inexpensive materials that can be used for this purpose, but
its strong corrosive properties render it dangerous to handle.

3. Rootstocks may be starved to death by preventing the development
of green leaves or other parts above ground. This may be prevented by
building straw stacks over small patches, by persistent cultivation in
fields, by the use of the hoe or spade in waste places, and by salting the
plants and turning on sheep in permanent pastures.

There are some weeds like northern nut grass that require special
treatment. Where this weed is abundant, the soil is poorly drained; much
may be gained by draining before the crop is put in. Harrowing such a
field will do little good. It must be cultivated early and late, and it may
be necessary to use the hoe to entirely remove the weeds.

*Weeds, and how to kill them—Farmers' Bulletin No. 28.
Pammel: Weeds of corn fields.