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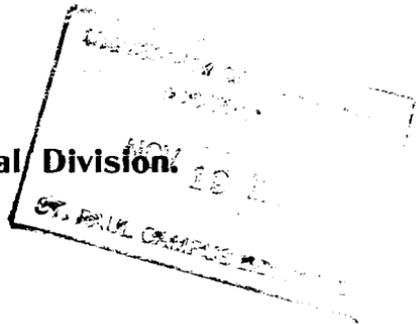
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Agricultural Experiment Station.

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Agricultural Division.



MARCH, 1906.

Some Common Weeds and Their Eradication.

ST. ANTHONY PARK, RAMSEY COUNTY, MINNESOTA.

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SOME COMMON WEEDS AND THEIR ERADICATION.

A. D. WILSON.

This bulletin is suggested by numerous inquiries which come to the Station as to the best methods of eradicating certain common weeds, and it is prepared to answer these inquiries. It is not offered as a scientific treatise on the subject of weeds but rather as a simple statement of some of the facts about weeds, which may be of value to Minnesota farmers. In its preparation Experiment Station bulletins have been freely consulted.

LOSS CAUSED BY WEEDS:

There is no accurate way of getting at the loss which weeds cause to the state annually, but it is safe to say that it is several hundreds of thousands of dollars. Not alone do weeds make it much more expensive to grow crops, but they make a heavy draft upon the moisture and fertility of the soil, besides reducing considerably the market value of the product.

A report from the Minnesota grain inspection department shows the average dockage per bushel on wheat for two years to be 19 ounces. This dockage is very largely due to weeds. Minnesota produces annually about 200,000,000 bushels of small grain. A dockage of 1 pound per bushels means a loss of 200,000,000 pounds. Had the land been free of weeds the same amount of plant food, moisture and labor would have produced over three million bushels of wheat or the equivalent in other grains. This makes an annual loss due to weeds of about two and one-half million dollars, or an annual rental of about 30c per acre on every acre on which small grain is grown. Added

to this great loss we must include cost of fighting weeds, loss of fertility and moisture, strain on machinery, extra cost of twine to tie up the weeds, freight charges for shipping weed seeds, etc.

DOCKED 23 POUNDS PER BUSHEL:

Some years ago the writer wrote to a friend for a sample of wild oats. This friend simply mailed a sample of wheat as it was being marketed by a farmer in the grain growing section. This statement accompanied the sample: "This wheat is being docked 16 pounds per bushel for wild oats." Surely this levies a very heavy tax on farming. Another farmer in this state marketed wheat this year on which he was docked 23 pounds per bushel, chiefly for wild oats.

HOW WEEDS GET INTO THE FIELDS:

Weeds have a great many ways for wide distribution. The seeds are carried by water, by wind, by birds, and animals, and by machinery. The last two are the most common methods of infection and also the most easily controlled by the farmer. The seeds of some of the worst weeds will pass through the digestive tract of some farm animals without injury to germination. Seeds of wild oats will pass through horses and still grow. Fields are often infected with wild oats from the droppings of horses fed grain in which there are wild oats. It will pay to grind for feed grain in which there are wild oats. Threshing machines are a common means of conveying weed seeds from one farm to the next. Farmers should insist that threshing machines be well cleaned out before moving from a weedy farm onto theirs. Seed grain is also a very common method of distributing weed seeds. Caution should be exercised in importing new varieties of grain and especially grass seed, that no undesirable seed be introduced. All seed grain should be well cleaned.

WEED SEEDS LIVE FOR YEARS IN THE GROUND:

It is a well known fact that the seeds of some of the worst weeds will live in the soil under certain conditions,

for several years. The North Dakota Experiment Station some years ago, conducted an experiment to determine the length of time seeds would retain their vitality in the soil. It was found that some wild oats would grow after having been buried twenty months but were all dead after fifty-six months. Some of the mustard and French weed seeds grew after being buried fifty-six months. These facts need not discourage the farmer for a season of careful cultivation will bring most of the weed seeds into conditions which will cause their germination. The few remaining to grow later can be removed cheaply by pulling or subsequent cultivation.

FARMS CAN BE CLEANED OF WEEDS:

Some farmers seem inclined to "give up" when their farms become badly infested with weeds. This may be the best thing they can do unless they are ready to change somewhat their methods of farming. Continuous grain raising and weedy land usually go hand-in-hand. The weeds are simply an ever recurring reminder that this class of farming cannot be carried on indefinitely. Those who have been convinced of this fact and have adopted a system of diversified farming are forgetting all about their old troubles with weeds. A system of rotation of crops which provides for one or more years in cultivated crops and one or more grass crops on each field in five to seven years, will eventually clean a field of most weeds, increase the net income per acre and tend to increase instead of decrease the soil fertility. Fields badly infested with the worst perennial weeds may be cleaned if strenuous efforts are followed as suggested below:

THREE CLASSES OF WEEDS:

There are not a great many different kinds of weeds which are troublesome in this state under ordinary farm conditions. For convenience in study, weeds may be divided into three general classes and so far as the farmer is

concerned they may be treated about the same, as but three kinds of weeds. These three classes are :

1. Annual weeds.
2. Biennial weeds.
3. Perennial weeds.

Annual weeds are those which produce seed in one year and die; in this class we find the common weeds such as pigeon grass, pig-weeds, lambsquarter, wild oats, wild mustard, corn cockle, wild buckwheat, cockle bur, French weed and kinghead or ragweed.

Biennial weeds are those which require two years in which to produce seed from seed. The seed germinates and the first year simply a rosette of leaves is produced. The root lives over winter just as a clover root does. Seed is produced the second year and the whole plant dies, root and all. This class of weeds is well represented with us by the bull thistle and burdock.

Perennial weeds are those which live from year to year, usually by underground stems or root stalks. In this class we find such weeds as quack grass, Canada thistle, morning glory, and sheep sorrel. These weeds, like the others, start from seed but the root or underground portion is permanent and unless destroyed in some way, sends up new shoots each year in its attempts to produce seed. These weeds not only persist in growing when prevented from seeding but spread, and often quite rapidly, by means of their underground root stalks.

ERADICATION OF ANNUAL WEEDS:

The essentials for getting rid of annual weeds are to use clean seed, prevent any plants which may be in the field from going to seed, and to prevent the infesting of the field by such mechanical means as threshing machines, wind, water, animals, etc.

To prevent weeds from seeding is much more easily said than done. Many of the weeds produce seed or

ripen earlier than do grain crops. This is especially true of wild oats, mustard and French weed. Others such as pig weeds, pigeon grass, etc., send up new shoots or branches after they are cut off by the binder and produce seed in the stubble fields before they are plowed under. It will be seen from the above facts that the ordinary methods of continuous grain growing cannot help but get the land full of weeds, for when once they get a foothold there is nothing to prevent their increase. The numerous fields in the state which are yellow with mustard at certain seasons of the year and the thousands of carloads of grain that are docked from one to twenty pounds per bushel for wild oats attest this fact.

Sometimes it is not practical or at least not considered so by the farmer to change materially his method of farming, but still he is anxious and finds it an absolute necessity, to do something to check the weeds before they get complete possession of his fields. This he may do in several ways, some of which are suggested below:

DISCING STUBBLE FIELDS:

Stubble fields may be disced as soon as the shocks are removed, to cover some of the weed seeds and cause them to germinate. Germinating the seed of an annual weed is usually sufficient to kill it, and the only thing to look out for is that the plant resulting from its germination is killed before it has a chance to produce seed.

WEEDS GERMINATE IN THE FALL:

Many of the annual weed seeds if covered in the fall will germinate and be killed by the frost or by subsequent cultivation. Wild oats from the 1905 crop were planted at the Experiment Station in September and seventy per cent of them germinated. Quite a large per cent of wild mustard and wild barley (squirrel tail) germinated under the same treatment.

PASTURING STUBBLE FIELDS:

Live stock, especially sheep, may be turned into the stubble field during the fall, if convenient. They will eat many weeds and weed seeds. Tramping the weed seeds into the earth will cause many of them to germinate, thus killing them. By sowing rape and turnip seed with the grain crops quite an amount of fall feed can be grown in place of weeds and if fed off with sheep or live stock of any kind, many weeds will be destroyed. Corn fields at the Experiment Station in which 3 pounds of rape seed were sown per acre just before the last cultivation produced an excellent crop of rape and practically no pigeon grass or other weeds. Corn fields without rape usually allow more or less weeds to go to seed after cultivation is stopped.

USE OF WINTER GRAIN CROPS:

The raising of winter grain crops of wheat or rye is very beneficial in cleaning land of weeds. The fall cultivation causes many seeds to germinate in the fall and to be killed by frost. Winter grain usually ripens early enough to be removed and the land plowed before any of the weeds which germinate in the spring can go to seed. This is true of most annuals, with the exception of French weed.

USE OF QUICK-GROWING CROPS:

Barley and similar crops are beneficial in eradicating weeds. Under favorable conditions barley will ripen soon enough to check to a large extent the seeding of such weeds as wild oats. To use barley to advantage for this purpose it is well to cause as many weed seeds to germinate in the fall as possible. This can be done by discing or by shallow plowing (2 inches deep) and harrowing, as soon as the crop is removed. This can be done at a cost of from forty cents to one dollar per acre. Such treatment will cover most of the weed seeds, will conserve soil moisture, and will cause many weed seeds to germinate that would otherwise lie on top of the ground, to be plowed

under later and give trouble. Plow later in the fall after a good many of the weeds have started to grow. Harrow as soon the next spring as the land is dry enough. This will warm up the soil and help to germinate the weed seeds.

It is important to get as many seeds to germinate at this time as possible. During the first or second week of May disc and harrow the field to kill all weeds growing. Prepare a good seed bed and sow as early a variety of barley as you have. Sow two bushels per acre to insure a good stand. By sowing barley late many of the weeds are killed by cultivation before the barley is sown. The warm weather at this season promotes the rapid growth of barley which checks the weeds and the barley will mature before most of the weeds, and will allow early fall plowing which is very desirable in killing weeds.

Other similar crops, as millet, buckwheat or rape may be used in the same manner with good results. This will not clean a field completely in one year, but is a long step in the right direction.

USE OF CULTIVATED CROPS:

Cultivated crops such as corn, potatoes etc., are the best class of crops with which to combat weeds. If neglected, such crops are but breeders of weeds. However, there is no class of crops on which better work can be done or which respond more generously to good cultivation than do cultivated crops. As a general rule all the labor put on a corn or potato crop is repaid by an increased yield of the crop. The frequent cultivation of the soil kills all weeds before they mature seed, and brings into the proper condition for germination, most of the weed seeds in the soil. Cultivated crops if properly handled are rightly named "cleaning crops."

PULLING BY HAND:

When some of the bad annual weeds as wild oats and mustard are but thinly scattered through

the field they may be removed quite cheaply by hand pulling. This method is not in general favor with Minnesota farmers. It is, however, often economical to remove weeds entirely by hand pulling or to pull the few weeds remaining after some other method of eradication. A year of cultivated crops as corn, or a year of bare fallow usually leaves the soil in good condition for a grain crop. Neither of the above methods is likely to entirely free a badly infested field of weed seeds. The few remaining seeds will germinate and unless the plants are removed from the grain field are liable to seed and leave the soil as foul as before. In such a case hand pulling is certainly practical.

ROTATION THE TRUE REMEDY:

Where a practical system of rotation is followed the fight with weeds is forgotten. Rotation of crops consists of some systematic alternation on each field, of the three general classes of field crops, namely: Grain crops, grass crops, including clovers, and cultivated crops. The object is to produce the grain, pasture, and forage needed on the farm, at the least expense of labor and fertility. Grass crops give weeds a very poor chance to produce seed as they grow thickly and ripen for hay earlier than most of the weeds produce seeds. If the land is very foul of weeds when seeded to grass a corn or other cultivated crop should follow the grass crop to insure killing the weeds from the seeds which have lain dormant during the time the land was in grass. Grass crops, especially when wholly or partially clover, enrich the soil and leave it in good mechanical condition. The succeeding crops grow heavier and more rapidly thus giving the weeds less chance than on poorer soil. If the land is reasonably free of weeds one to four grain crops may follow the grass crop. A cultivated crop should then be introduced to again clean up the land and to prepare the soil for the next grass crop. Disc'd corn stubble furnishes one of the best conditions for getting a stand of grass.

VALUE OF ROTATION DEMONSTRATED:

The value of rotation in ridding land of weeds is well illustrated by two plats at the Experiment Station. One plat on which wheat has been grown continuously for eleven years is quite badly infested with wild oats. Another plat two feet away from the first one, on which a five year rotation (wheat, grass, grass, oats and corn) is followed, is free of wild oats.

If any farmer in Minnesota who is now troubled with any of our common annual weeds will lay his farm off in convenient shaped and sized fields, and follow a system of rotation, using a well cultivated crop of corn once in five to seven years, and one to three grass crops during the same time he will have but little trouble with weeds, will increase the products of his farm until he will consider the weeds a blessing for having forced him to change his methods of farming.

SUMMER FALLOW:

When all other methods fail or are for some reason impractical a thorough bare fallow can be resorted to as a very effective remedy against annual weeds. To get good results from bare fallowing three principles must be kept in mind: 1st, all weeds that germinate must be destroyed before they produce seed; 2nd, all seeds in the soil should be brought where they will germinate; 3rd, seeds will germinate only under the proper conditions of heat, air and moisture. To illustrate: Stubble fields may be disced or plowed in the fall to cover weed seeds, thus bringing them in contact with the moist soil so they will germinate. Harrowing land in the spring warms up the soil and lets the air in, thus promoting germination. The seeds near enough to the surface will germinate while those deeper in the soil where it is cooler and where the air does not penetrate freely will lie dormant or decay. Thus only a small portion of the weed seeds in the soil are brought into conditions favorable for germination at any one cultivation. When the weeds

started by the spring harrowing are plowed under late in May or early in June (just before they are large enough to produce seed) the seeds that were too deep to grow are now turned on top, where, if the soil is harrowed to retain the moisture, they will germinate, thus ridding the soil of some more weed seeds. The usual practice of plowing in June and leaving the soil as plowed does not give the best results because the furrow slice dries out and the seeds turned up cannot germinate. It is sometimes necessary in dry seasons to roll land as well as to harrow it at this time of year to pack the furrow slice down to the sub-soil so that the moisture necessary for germination can move up from below by capillary action. Always try to keep the soil moist and loose and plow before weeds can go to seed and summer fallowing will give good results. To get best results from fallowing it is usually necessary to plow twice during the season and harrow the first plowing two or three times. Summer fallowing is not to be recommended except in rare instances. One year's crop and considerable labor is lost and it is also very wasteful of plant food. It is wholly unnecessary to summer fallow where rotation is practiced.

ERADICATION OF BIENNIALS:

This class of weeds very seldom give any trouble in cultivated fields. Bull thistles and burdock are, however, quite common in pastures and waste places. With them as with the annual weeds the line of attack is to prevent them from seeding. This can not always be done by mowing as some of the lateral branches are liable to be left by the mower and grow up and produce seed. Cutting off just below the surface of the ground, with a spud or other implement one to three times during the year will kill them. Where the pastures and meadows are worked in a rotation, that is left in grass but two or three years then broken up and sown to grain and corn for a few years, these weeds give but very little trouble.

COMMON WEEDS AND THEIR ERADICATION. 205
ERADICATION OF PERENNIAL WEEDS—QUACK GRASS,
CANADA THISTLE, MORNING-GLORY, ETC:

These are by far the worst weeds we have to combat. Canada thistle is becoming quite common in the Red River Valley and quack grass is all too common in the southern half of the state. Simply preventing these weeds from seeding is not sufficient to destroy them. They grow by underground stems or root stalks, consequently grow and spread though prevented from seeding. The roots do not die as do annuals or biennials but live from year to year and send up new plants each year. Even a small piece of root if left in the ground will send up a good vigorous plant and begin to spread by sending out new root stalks. It will be seen from this that such weeds must be attacked by some method that will kill the roots. Ordinary field operations such as plowing, cultivating, etc., help to tear the plants up from one place but the roots are caught by the implement and scattered about the fields where they at once make their home and begin to grow. One of the first essentials of handling perennial weeds should be to use every effort to prevent scattering them about. Each patch should be marked and worked around so as to avoid scattering the weeds with the harrow or other machine. In this way much future trouble can be avoided.

EASY METHODS NOT USUALLY SUCCESSFUL:

Many easy methods of combatting perennial weeds have been suggested and tried, but such methods are likely to result in only partially killing them, consequently very little is accomplished unless it is to discourage the man who tried them.

SMOTHERING:

Many have tried to smother these weeds with quick growing crops, such as buckwheat, millet or hemp. In 1905 the Experiment Station sowed hemp thickly on a piece of ground in which there were a few patches of quack grass. The hemp was very thick and

turing it if convenient to do so, then turn it under deeply and completely, by plowing the land as deep or even one or two inches deeper, than it is usually plowed. At this period of its growth the old root stalks will have given up the seed-like nourishment, which they stored up the year before, in helping form the new growth of leaves, stems and root stalks. These old root stalks will be ready to decay and the new root stalks, as yet green and succulent, will not have stored up in themselves food for another year and they also will not resist decay long. The plant at this period is in its most active vegetative stage and is not prepared with a supply of stored-up food in its root stalks to long endure a resting period. Simply plowing under is, however, only the commencement of the attack. The plants are full of active vigor and the young root stalks at once start up new leaves and stems. Leaves are a necessity to the plant at this time and if we can prevent it having any of these 'breathing and digesting' organs it will soon starve and the root stalks will die. To destroy all leaves it is necessary to thoroughly cultivate or occasionally plow the soil at short intervals of one to three weeks. In case the cultivating implement does not do quite thorough work it is necessary to destroy the remaining blades with the hoe, since the rule should be to 'not let the grass see daylight.'

"By this plan many farmers have killed this pest. While it has cost them the rental value of the land for one year, and the labor of several times plowing and cultivating, they have plowed under some green manure, and have given the soil such a thorough summer fallowing that it is in fine condition for a crop the next season. While summer fallowing is hardly to be recommended even in this northern climate where the soil is frozen nearly half the year, save as an occasional expedient, yet in this connection we need not ignore its advantages. The first plowing as above mentioned is sufficiently early to destroy other weeds, even French weed, before they ripen seeds. The repeated cultivating and the occasional plowing brings other weed seeds into their germinating zone of soil and they are destroyed. In addition to the accumulated fertility, which is set free and stored up during the year, the summer fallow also conserves moisture for the next season's crop, and the cleaning, fertilizing and moistening of the soil does much to reduce the ultimate cost of this method of killing quack grass. While the farmers who have followed this plan of entirely eradicating this pest have good words for it, those who have each year for several seasons 'nearly killed' this weed by fairly careful cultivation, but yet have it in their fields, are complaining that it costs them annually a great deal of labor to combat this pest, and it seems to have the mastery.

"Where necessary, and practical to do so, turnrows, and where the fence may be removed, fence rows, and the borders of public roads, should be included in the summer fallow. This will avoid having the grass again encroach upon the field from the surrounding land.

"Doubtless there are many other ways of killing quack grass which would succeed, but farmers make a mistake in experimenting with theories of killing 'by turning the roots up to the sun,' by 'exposing the roots to the action of the frost,' and some other oft recommended remedies. Methods which at once succeed are in the end the most economical."

The past three years it has been very hard to deal with quack grass, owing to the excessive amount of rainfall and many attempts to kill quack grass have been unsuccessful. These years, however, are uncommon. Under ordinary Minnesota conditions the above method if carefully carried out will succeed. To be on the safe side, however, a year of such treatment should be followed by one or more years of cultivated crops. Great care should be exercised to find and destroy the occasional plant which escaped the previous year's cultivation. A similar course of treatment will destroy the other perennial weeds. In fact, none of them are quite so hard to handle as is quack grass. It is not expected that the whole farm will be cleaned in one year, but that the farm will be divided into fields and one field cleaned each year.

ROTATION OF CROPS:

The rotation of crops as usually carried on is not proof against quack grass. For this reason bare fallowing is recommended, but if a part of the farm is taken at a time and planted to corn and the corn very carefully cultivated and hoed by hand the quack grass can be killed in a year or two and at the same time good crops can be grown on the land. The careless methods of farming commonly practiced in the grain growing sections of the country make this method impractical under most conditions. Once the land is cleaned by thorough bare fallow the danger of getting it infested again is greatly

lessened by a rotation of crops for in this way the whole of the farm is brought into cultivated crops at regular intervals and these weeds will then be noticed if present and checked before they spread very far.

CLEAN SEED:

One of the essentials of keeping a farm free from weeds is pure seed grain. Great care should be taken in getting seed from any outside source that it is free from any bad weed seeds. This precaution is especially necessary when grass seed is purchased. As a general thing the safest and best source of seed grain for the farm is grain raised on the farm the year before. The idea that seed runs out after growing on a farm for a few years, and must be renewed occasionally is not founded on facts. Experiments conducted by experiment stations, comparing home grown seed with that brought from a distance have resulted in every case in favor of the home grown seed, where careful methods have been used in the selection of the same. **Save your own seed and clean it.** It is almost impossible to separate some of the worst weed seeds from seed grain where ninety bushels of seed must be "cleaned up" from 100 bushels of dirty grain. It is too generally the practice to market all of the grain but just enough for seed, then try to clean what is retained. This is practically impossible if the grain contains such weed seeds as wild oats, wild buckwheat, cockle or ragweed. It is of course very poor policy to sow weed seeds.

A BETTER METHOD:

Where live stock is marketed the best animals are retained on the farm for breeding purposes. If a bin of grain is examined it will be found that the kernels of grain vary as much as do the animals in a herd of cattle. It is therefore as practical to save for seed the best individual kernels from all the grain raised as to

save for breeding purposes the best individuals from all the animals raised. It is a recognized fact that strong, vigorous animals will give birth to stronger offspring and nourish them better than will weaker animals. It is likewise a fact, though not so generally recognized, that heavy plump kernels of grain will produce stronger offspring and nourish them better than will the smaller, lighter kernels. This fact has been demonstrated by many careful experiments. **Separate out for seed, but five to twenty per cent of the best of all the grain raised.** This may be done at a cost of a very few cents per bushel on the seed saved and without lowering materially the grade of the balance of the grain for market. This small amount of the heaviest and plumpest seed may be saved practically free from weeds though the bulk of the grain is quite foul.

Fig. 164 and description suggests a method by which this separation may be easily made with most "side shake" fanning mills. End shake fanning mills can be made to separate out the large plump kernels by using a coarse enough screen in the bottom shoe to let all but the very largest kernels through into the market grain carrying but a small percent of the largest to the front end of the machine for seed.

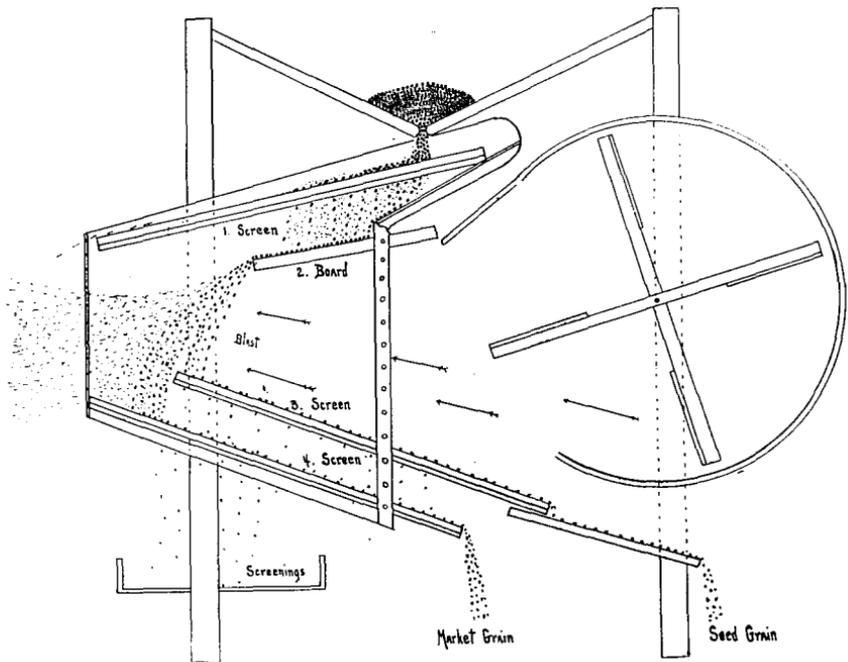


Fig. 164.—“Side Shake” Mill, set for grading seed grain.

Screen No. 1 should be just coarse enough to let the grain through. It is used simply to run off sticks and straw. Board No. 2 carries the grain backward in the mill so as to let it drop through the blast at one place. The light kernels are blown past the end of screen No. 3, the heavier kernels fall on screen No. 3. Board No. 2 may be moved forward or backward to throw a large or small per cent of grain on screen No. 3, as desired. Screen No. 3 should be coarse enough to let the small kernels through onto screen No. 4. It is adjustable as to slant and may be moved forward or backward to regulate the amount of grain it will catch. Screen No. 4 is fine enough to carry nearly all of the grain over into market grain. Any side shake mill may be fixed up in this way. Separation by weight cannot be made with the end shake mills but the large kernels can be separated from the small ones in any proportion desired, simply by using coarse or fine screens in lower part of mill.



Fig. 165.—Corn Cockle. (Photo. by H. D. Ayer.)



Fig. 166.—Seeds of Cockle, enlarged. (Photo. by H. D. Ayer.)

CORN COCKLE.

Corn Cockle or Blue Cockle, shown in Fig. 165, is an annual. It is common in grain fields, especially in wheat. It ripens about the same time as wheat. The seed does not shell out easily so is usually removed from the fields with the grain crop.

To eradicate: Use only pure seed. It is very hard to separate cockle from wheat as the seeds of wheat and cockle are of about the same size and weight. By grading out only a small portion of the whole crop of wheat for seed as suggested on page 212 this small portion can be saved practically pure and the cockle left in the market grain.

If it is necessary to use grain for seed that has cockle seed in it, the cockle should be pulled from the field by hand. Enough at least to give seed for the following year should be thus picked.

WILD OATS.

Wild Oats, shown in Fig. 167, is an annual. It is one of the most common and worst of the annual weeds. The seeds ripen earlier than wheat and oats. They shatter easily and are usually left on the ground when the grain crop is cut.

To eradicate: Use only clean seed; prevent them from seeding; use quick-growing crops as barley, or millet; sow winter wheat and rye as they ripen earlier than wild oats; or use grass crops, and cultivated crops in rotation. See "Eradication of Annuals," page 198.



Fig. 167.—Wild Oats.—Showing seeds of wild oats and tame oats, enlarged. (Photo. by H. D. Ayer.)



Fig. 168.—Wild Barley. (Photo. by H. D. Ayer.)

WILD BARLEY.

Wild Barley or Squirrel Tail, shown in Fig. 168, is an annual. It ripens seed very early and is troublesome in meadows, pastures and waste places. It is very bad in hay as the awns make the animals' mouths sore. It is not usually troublesome in cultivated fields.

To eradicate: Rotate the pastures and meadows with grain and cultivated crops, if possible. If this cannot be done prevent the barley from seeding by mowing several times during the season. Sow bromus, blue-grass or clover to crowd out the wild barley in places that cannot well be cultivated.



Fig. 169.—Pigeon Grass. (Photo. by H. D. Ayer.)

PIGEON GRASS.

Pigeon Grass or Foxtail, shown in Fig. 169, is an annual. It is very general in all cultivated fields in Minnesota. It seeds abundantly from July to November. The plants send up stools after harvest that produce seed and thus infest the land.

To eradicate: Use clean seed. The seed is easily cleaned from any kind of grain but flax. May be cleaned from flax as indicated on page 212. Fall pasturing, early fall plowing, cultivated crops, growing of rape, grass crops, and rotation of crops are all beneficial in holding this weed in check. See "Eradication of Annuals," page 198.



Fig. 170.—Wild Mustard. (Photo. by H. D. Ayer.)

WILD MUSTARD.

Wild Mustard, shown in Fig. 170, is an annual. It is very common in grain fields. It ripens an abundance of seed from June to November; consequently very troublesome; under favorable conditions seeds will remain in good growing condition in the soil for several years. It cannot be eradicated in one season.

To eradicate: Use only clean seed; prevent plants from seeding by pulling, by using quick growing crops as barley or millet, by using grass crops and carefully cultivated corn crops; by rotation of crops, or by bare fallow if necessary. See "Eradication of Annuals," page 198.

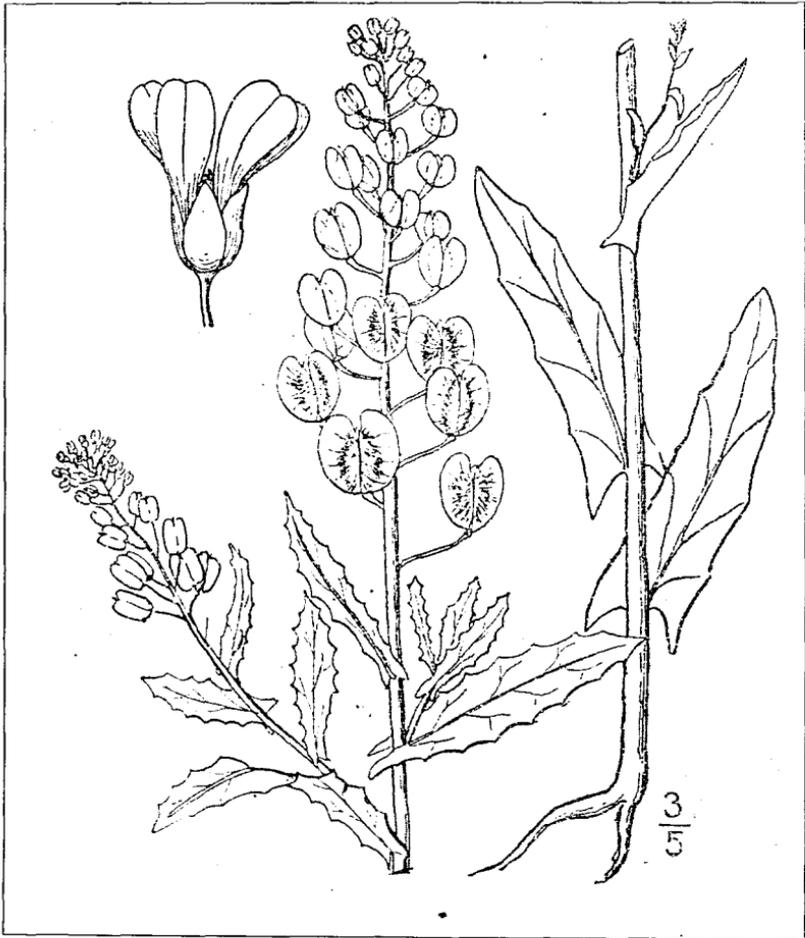


Fig. 171.—French Weed. (After Britton & Brown.)

FRENCH WEED.

French Weed, or Stinkweed, illustrated in Fig. 171, is an annual and a very troublesome little weed belonging to the mustard family. It seeds from May to November, hence it is quite hard to handle. It seems to thrive with most any crop. The seed will germinate in the fall and the plants live over winter and produce seed the next year or the seed may start in the spring and produce seed in a few weeks.

To eradicate: No definite method has been determined for combatting this weed. The course to follow is to get as many seeds to germinate as possible before a crop is sown so they can be killed by cultivation. Then plant a cultivated crop or a thick-growing crop as barley or millet. For example, discing and harrowing the stubble fields right after harvest will cause many of these seeds to germinate. Plowing later in the fall will kill them. Harrowing early in the spring and at intervals of one or two weeks, will warm up the soil and cause many of the seeds to germinate. By discing the land thoroughly about the middle of May or first of June will kill all the plants started. A crop of barley or millet or fodder corn will then give the French weed little chance. See "Eradication of Annuals," page 198.



Fig. 172.—Seeds of French Weed, enlarged. (Photo. by H. D. Ayer.)

FALSE FLAX.

False Flax, shown in Fig. 173, is an annual belonging to the mustard family. It is common only in flax fields. The seed is difficult to separate from flax seed. Most of it may be removed by method shown on page 212. It is distinguished from flax by small yellow blossoms and by its pear-shaped pod. The seeds are longer and rounder. See Fig. 172.

To eradicate: Use clean seed; rotate crops, using grass and cultivated crops; use also quick-growing crops and if necessary summer fallow. Avoid growing flax oftener than once in seven to ten years. See "Eradication of Annuals," page 198.

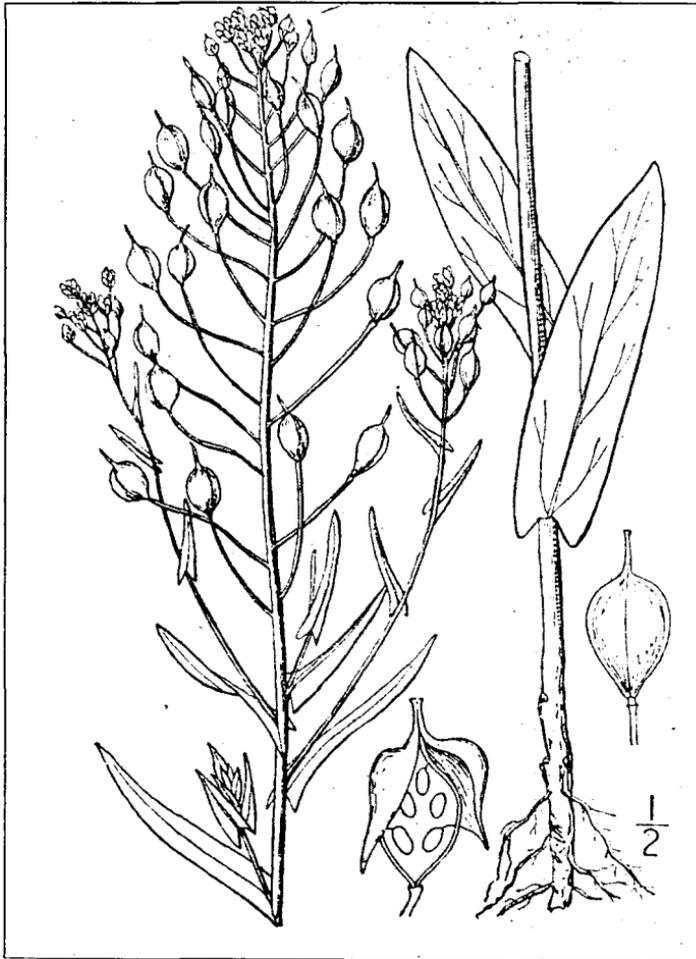


Fig. 173.—False Flax. (After Britton & Brown.)



Fig. 174.—Seeds of False Flax. (Photo. by H. D. Ayer.)

WILD BUCKWHEAT.

Wild Buckwheat or Black Bindweed, shown in Fig. 175, is an annual. It is a twining plant very common in old grain fields. The seeds are triangular and about the same size as wheat.

To eradicate: Use clean seeds. These seeds are rather difficult to separate from grain, owing to size of the seeds. They can, however, be separated from the seed grain as suggested on page 212. Under systematic rotation of crops and good cultivation, wild buckwheat is not troublesome. See "Eradication of Annuals," page 198.

LAMBSQUARTER.

Lambsquarter, shown in Fig. 176, is often called pigweed. The difference will be seen at once by observing Figs. 176 and 177. It is an annual weed, common in gardens and cultivated crops. Not usually common in grain fields. Seeds profusely. Seeds, very small and are very easily separated from seed grain.

To eradicate. Use clean seed, carefully cultivated corn and similar crops, or rotate the crops. See "Eradication of Annuals," page 198.



Fig. 175.—Wild Buckwheat. (Photo. by H. D. Ayer.)



Fig. 176.—Lambsquarter. (Photo. by H. D. Ayer.)



Fig. 177.—Pig Weed. (Photo. by H. D. Ayer.)

PIG WEED.

Pig Weed, shown in Fig. 177, is an annual weed. It is common in gardens, yards and corn fields. It is usually not bad in grain fields. It seeds profusely. The seed is easily separated from grain.

To eradicate: Use clean seed. Carefully cultivate corn and similar crops. Rotate. See "Eradication of Annuals," page 198.

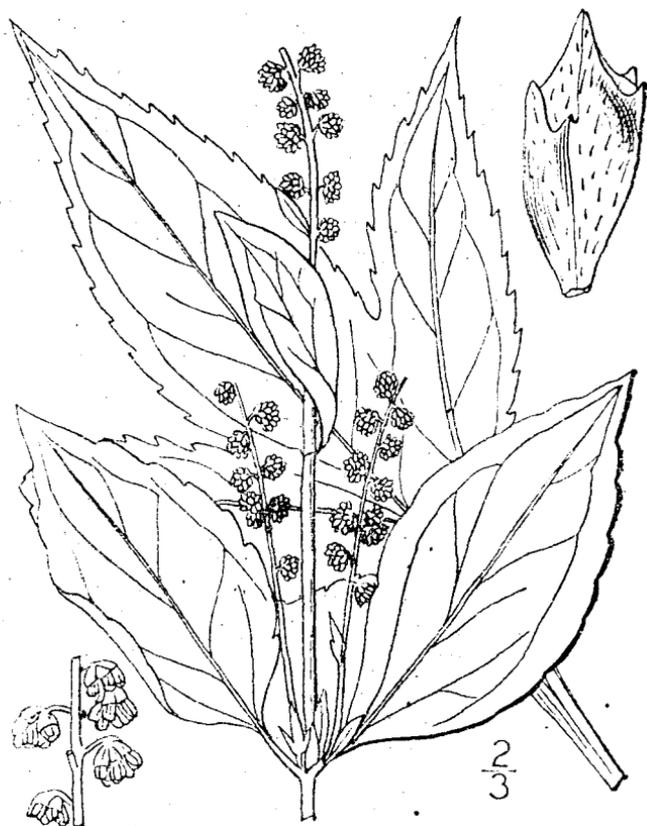


Fig. 178.—Giant Ragweed. (After Britton & Brown.)

RAG WEED.

Ragweed, shown in Figs. 178 and 179, is an annual. The Giant Ragweed is common in the Red River Valley. It is found in grain fields and in any cultivated field.

To eradicate: Use clean seed. The seeds are very difficult to separate from wheat since they are about the same weight and size as the kernels of wheat but can be separated as shown on page 212. These weeds are easily killed in cultivated fields, by one season's cultivation. The rotation of crops is an effective remedy. See "Eradication of Annuals," page 198.



Fig. 179.—Smaller Ragweed. (After Britton & Brown.)

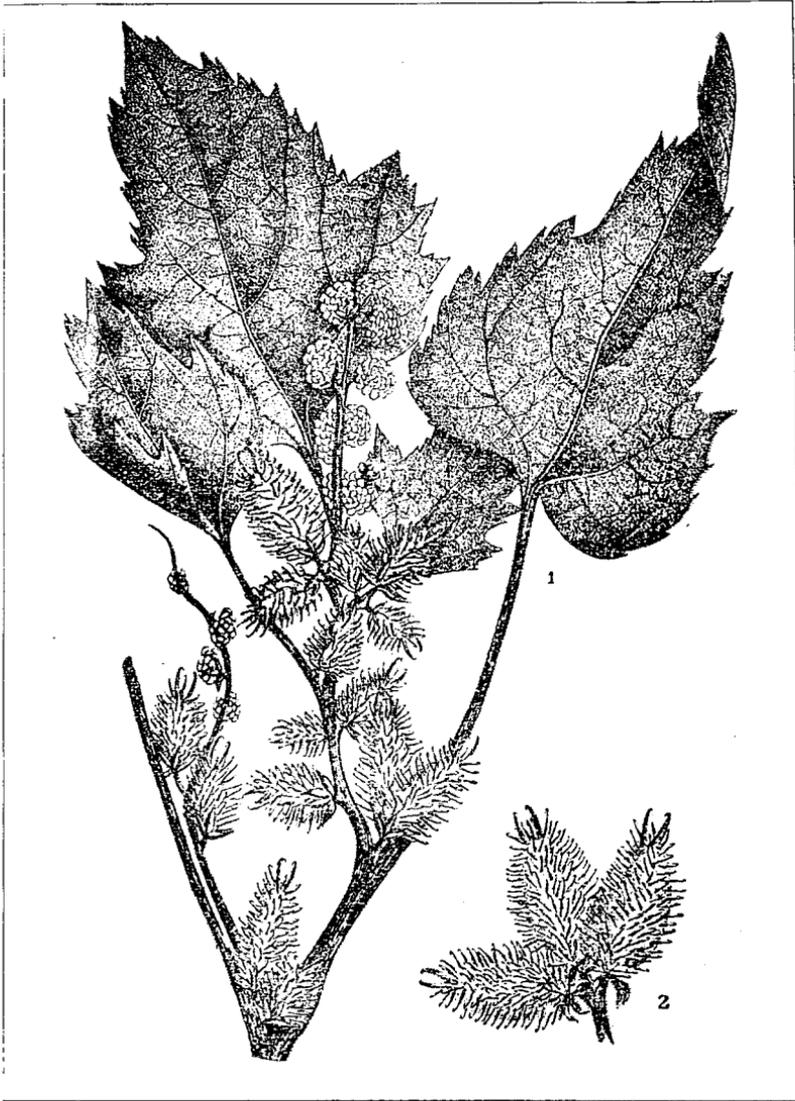


Fig. 180.—Cockle-bur. Compare with Burdock on opposite page.
(Div. of Botany, U. S. Dept. of Agr.)



Fig. 181.—Burdock. Compare with Cockle-bur on opposite page.
(Div. of Botany, U. S. Dept. of Agr.)



Fig. 182.—Bull Thistle. Compare with Canada Thistle on opposite page. (Div. of Botany, U. S. Dept. of Agr.)



Fig. 183.—Canada Thistle.—Compare with Bull Thistle on opposite page. (Photo by H. D. Ayer.)

COCKLE BUR.

Cockle Bur, shown in Fig. 180, is an annual. It is a coarse weed often confused with burdock. Appears most often in corn fields. Each bur contains two seeds. They are distributed by attaching themselves to animals. The difference between cockle bur and burdock will be seen by observing Figs. 180 and 181.

To eradicate: Since this weed is an annual simply cutting off the young plants kills them. Carefully cultivated corn and potatoes are the safest crops to grow to kill out this pest. The bur is quite tough and may protect the seed for several seasons before it germinates. Simply to keep them from producing seed in the most convenient way is the best method of attack. See "Eradication of Annuals," page 198.

BURDOCK.

Burdock, Fig. 181, is a biennial. It is a large coarse weed, common in pastures and waste places. Found sometimes in cornfields.

To exterminate: Prevent the weed from seeding by mowing and cultivating, by use of spud. See "Eradication of Biennials," page 204.

BULL THISTLE.

Bull Thistle, Fig. 182, is a biennial. It is found in pastures and waste places. The heads are larger than are those of Canada Thistles. The leaves are light colored and hairy beneath. It has a tap root instead of running rootstalks as has the Canada Thistle.

To eradicate: Prevent them from seeding by mowing, cultivating or by use of spud. See "Eradication of Biennials," page 204.

CANADA THISTLE.

Canada Thistle, Fig. 183, is a perennial. This weed is becoming all too common in the northwestern part of the state. The Canada Thistle is smaller than the Bull Thistle, has smaller heads and is usually found in thick patches. It spreads by seeds (in some cases) but usually by underground stems or root stalks. Instead of a tap root as is found on the Bull Thistle, underground stems or root stalks will be found which connect several plants.

To exterminate: Prevent seeding, starve out or kill root stalks by smothering, by persistent cultivation or by thorough bare fallow. See "Eradication of Perennials," page 205.



Fig. 184.—Morning-glory, in a barley field. (Photo. by H. D. Ayer.)

MORNING-GLORY.

Morning-glory, shown in Figs. 184 and 185. It is a perennial, twining plant. Found in old cultivated fields, especially in corn fields. It spreads by root stalks and by seeds.

To eradicate: Can be removed from corn fields by diligent use of the clutivator and hoe. Root stalks must be killed as suggested for Quack Grass or Canada Thistles. See "Extermination of Perennials," page 205.



Fig. 185.—Morning-glory, in corn field. (Photo. by H. D. Ayer.)

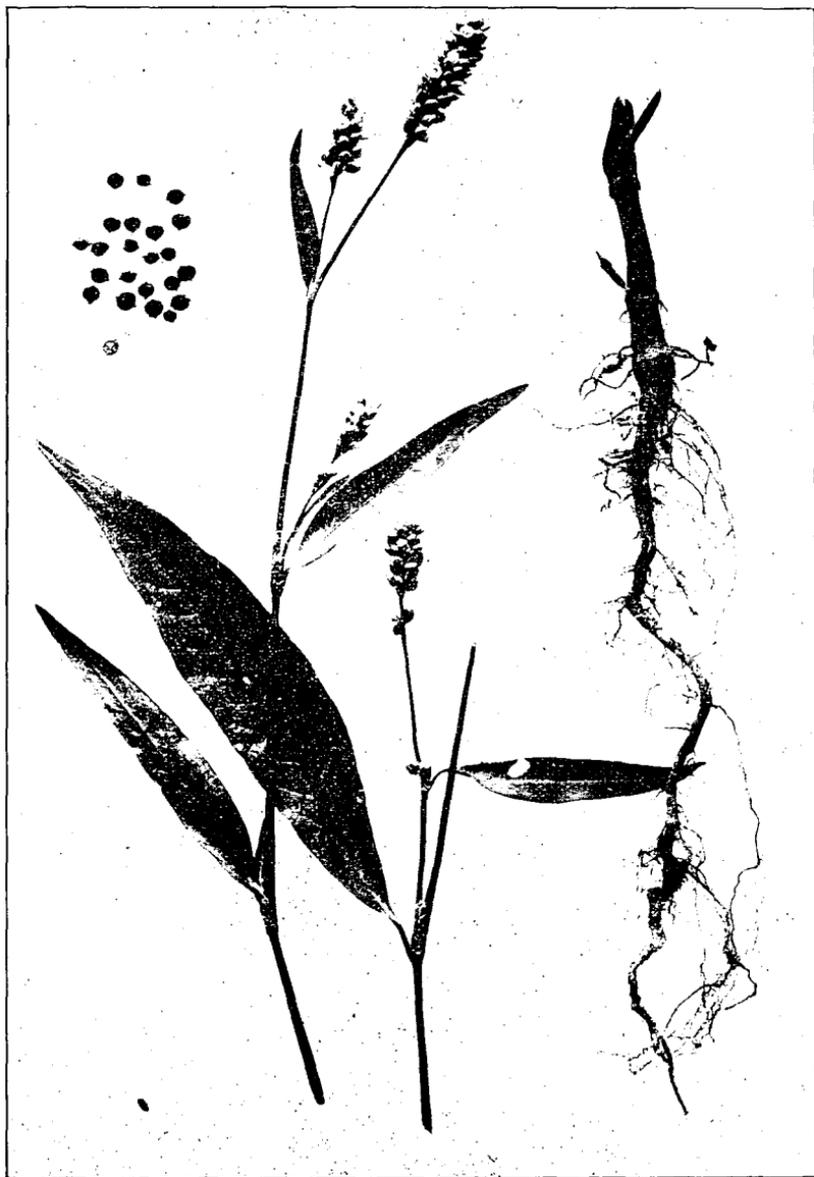


Fig. 186.—Smart Weed. (Photo. by H. D. Ayer.)



Fig. 187.—Curled Dock. (Div. of Botany, Dept. of Agr.)

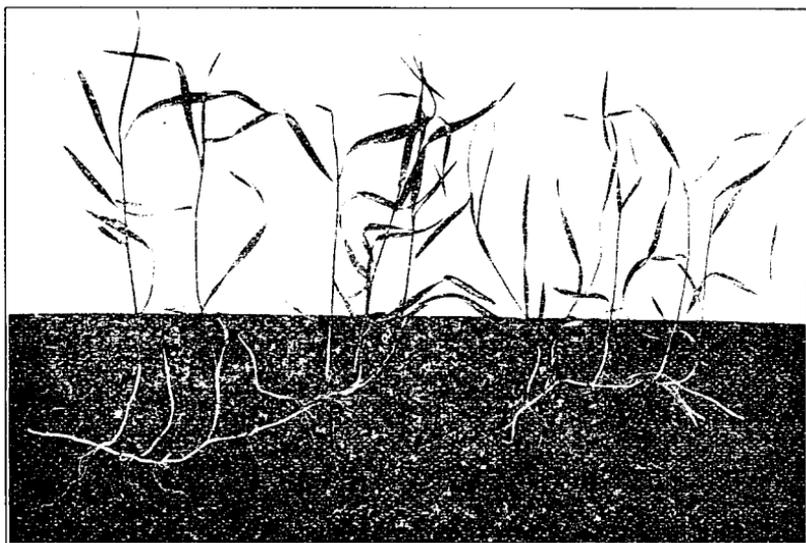


Fig. 188.—Quack Grass. (Photo by H. D. Ayer.)

QUACK GRASS.

Quack Grass, Fig. 188, is a perennial. It is all too common in this state. It is reproduced by seeds and by underground root stalks.

To eradicate: Prevent seeding; starve out or kill root stalks by persistent cultivation, by smothering, or by thorough bare fallow. See discussion under "Perennials," page 205.

CURLED DOCK.

Curled Dock, shown in Fig. 187, is a perennial. It is readily recognized from the cut. It is found usually in low moist places and in corn fields.

To eradicate: Use careful methods of cultivation, as corn well cared for, rotation of crops, or pull by hand. Drainage is also beneficial. See "Eradication of Perennials," page 205.

SMART WEED.

Smart Weed, shown in Fig. 186, is an annual or perennial. It is common in low moist ground. The seeds are small and shiny and are easily screened out of seed grain.

To eradicate: Good drainage; good cultivation, as a carefully cultivated corn crop, and rotation are some of the best methods of attack.

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Walt
John

Joe



