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WEEDS AND WEED SEEDS

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WITH NOTES ON SEED CLEANING



DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE
SEED BRANCH

GEO. H. CLARK, COMMISSIONER

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FOREWORD

This bulletin was first issued in 1911 and was published in conjunction with the Seeds Act and regulations thereunder. These regulations prescribed the kinds of weeds the seeds of which affected the utility value of seeds of commerce when occurring therein as impurities. Officers of the Seed Branch are charged with the administration of the Seeds Act, and are primarily responsible for determining which weeds shall be prescribed thereunder and the relative noxious nature of them.

The illustrations, descriptions and other information contained in this bulletin pertain to those weeds that are prescribed under the provisions of the Seeds Act. Having regard to the purpose of this bulletin methods of weed eradication are treated only briefly.

During the last quarter century this bulletin has been revised several times. In addition to the officers of the Seed Branch who have been responsible for the subject matter contained therein, the botanists and agriculturists of the Experimental Farms Branch, both past and present, the late botanists of the Geological Survey, provincial botanists and agriculturists and many individual farmers have made valuable contributions of information that has been employed in the preparation of the text.

In the preparation of this revised edition grateful acknowledgment is due to W. H. Wright, who prepared the illustrations of the additional weeds included herein and co-operated with Percy Overholt, also of the Seed Branch staff, in the revision of the text; to H. Groh, Botanist, Central Experimental Farm, who prepared the descriptions of four additional weeds; to Dr. E. S. Hopkins, Dominion Field Husbandman, who contributed new and valuable information respecting weed eradication and co-operated with a view to ensuring that the information pertaining to cultural practices is in harmony with those approved by him; and to T. K. Pavlychenko, Weed Experimentalist of the University of Saskatchewan, for making available the results of his recent research work on the control of Perennial Sow Thistle, Canada Thistle, Wild Oats and Quack Grass. It is felt that the usefulness of this bulletin has been substantially increased because of their co-operation and contributions.

GEO. H. CLARK,
Seed Commissioner.



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WEEDS AND WEED SEEDS

INTRODUCTION

The greatest difficulty in maintaining successful farming, and particularly in producing a more abundant supply of clean forage and grain seed, is the prevalence of weeds. In order to get the best returns from the land and to produce a high class of clean seed, farmers must be constantly on the alert to keep the weeds on their farms in check and prevent the introduction and spread of new kinds. In various ways weeds render farming more difficult and less profitable. They depreciate the market value of land and the quality and price of grain and forage crops; they rob the soil of moisture and plant food materials, thus increasing the effects of drought; they crowd out the crop plants and proportionately reduce the yield, being often more persistent growers and as a rule more prolific in seed production; under dry farming conditions they are the sole cause of the costly tillage operations before and frequently after the crop is seeded or planted out; they raise the cost of production because the eradication of the worst weeds is costly in machinery, labour and time, and frequently prevents a farmer from following the best farm practices or from growing the most advantageous crops; some weeds are harmful to stock, while others are injurious to their products; weeds attract injurious insects and harbour fungus diseases.

New weeds are introduced on farms with imperfectly cleaned cereals, clover or other commercial seeds, and with commercial feeding stuffs which often contain vital weed seeds. They are spread from district to district through the various transportation facilities, are disseminated within a locality in stable manure from towns and cities and are distributed from farm to farm through threshing machines and from field to field by farm implements. The wind carries weed seeds long distances not only in summer but with drifting soil and over the surface of the snow in winter. Streams distribute them along their courses. They are also distributed by herbivorous animals and seed feeding birds, through the stomachs of which the seeds pass undigested; or they attach themselves by special contrivances, such as hooked and barbed hairs, spines, gummy excretions, etc., to passing animals.

Weed Seeds in Farm Lands

It is important to consider not only the large number of weed seeds sown with improperly cleaned grain but also those already in farm soils. Some of our worst weeds are so prolific in the production of seeds that relatively clean fields may become badly contaminated in two or three years if these weeds are allowed to go to seed. For instance, a single plant of wild mustard, stinkweed, foxtail, pigweed or campion produces from 10,000 to 20,000 seeds, worm-seed mustard about 25,000, shepherd's purse about 50,000 and tumbling mustard about 1,500,000. With such productiveness, soils become quickly infested with weed seeds, although on account of their inconspicuousness the presence of the seeds is not fully realized. Only a careful examination will reveal their kinds and numbers, and with this object in view the Seed Branch gathered some data on the prevalence of weed seeds in farm lands. Fields were selected in Alberta, Saskatchewan, Ontario and Quebec, records of their culture and cropping were obtained, and samples of soil at different depths and in different parts of each

field were taken and examined at the Ottawa seed laboratory. In the four provinces 74 fields were selected from which 573 samples were taken, 191 from the surface, 191 from a depth of 2-3 inches and 191 at from 5-7 inches. From a definite weight of the air dried soil of each sample, the weed seeds were separated out, identified and counted.

To convey some idea of the prevalence of weed seeds in these samples, four typical fields under different conditions have been chosen and the seeds found in them are tabulated below. At Lacombe, Alta., a field was examined which had grown oats and barley regularly without summer-fallow for nine years. It was nearly always fall ploughed but was harrowed before ploughing to sprout the weed seeds. The tenth year it was seeded to timothy and alsike. The following is a list of the numbers and kinds of weed seeds found in samples from this field:—

Seeds found in 6 oz. of surface soil	Seeds found in 6 oz. of soil taken 2 to 3 inches deep	Seeds found in 6 oz. of soil taken 5 to 7 inches deep
Ball mustard..... 51	Ball mustard..... 59	Ball mustard..... 39
Lamb's quarters..... 78	Lamb's quarters..... 70	Lamb's quarters..... 69
Black bindweed..... 4	Black bindweed..... 2	Black bindweed..... 2
Grass..... 1	Sedge..... 1	Other sorts..... 2
	Other sorts..... 1	
Total..... 134	Total..... 133	Total..... 112

It is noticeable that the prevalence of weed seeds is nearly the same at all three depths.

Six ounces of air-dried soil has an approximate volume of 8.58 cubic inches, and from the above figures it may be calculated that a square yard of the surface inch of this field contains about 20,240 weed seeds.

Near Brantford, Ont., samples were taken from a field which had been in sod for six years, having either grown a crop of hay or been pastured each year during that time. The following weed seeds were found in these samples:—

Seeds in 6 oz. of surface soil	Seeds in 6 oz. of soil 2 to 3 inches deep	Seeds in 6 oz. of soil 5 to 7 inches deep
Ragweed..... 9	Black bindweed..... 17	Black bindweed..... 11
Black bindweed..... 67	Green foxtail..... 1	Lady's thumb..... 5
Green foxtail..... 20	Lady's thumb..... 8	Crabgrass..... 4
Lady's thumb..... 14	Crabgrass..... 22	Lamb's quarters..... 7
Crabgrass..... 11	Lamb's quarters..... 9	Old witch grass..... 1
Sheep sorrel..... 2	Sleepy catchfly..... 1	
Yellow foxtail..... 3	Knotweed..... 1	
Lamb's quarters..... 1		
Total..... 127	Total..... 59	Total..... 28

In this field the number of weed seeds in the surface inch greatly exceeds the number at either of the two lower depths. A square yard of the surface inch of this field contains about 19,183 weed seeds.

Samples of soil were taken from a field near Guelph, Ont., which for the preceding ten years had been cropped as follows: (1) meadow, (2) corn (field was fall ploughed the previous year), (3) oats, (4) bare fallow, (5) winter wheat seeded with timothy and clover, (6) pasture, (7) ploughed in early

summer, seeded with millet and thoroughly cultivated after millet was removed (this treatment was owing to the prevalence of white cockle), (8) barley, seeded with alfalfa, and years (9) and (10) alfalfa. The following weed seeds were found in these samples:—

Weed seeds in 6 oz. of surface soil	Weed seeds in 6 oz. of soil 2 to 3 inches deep	Weed seeds in 6 oz. of soil at 5 to 7 inches deep
White cockle..... 9	White cockle..... 6	White cockle..... : 6
Black medick..... 10	Black medick..... 8	Black medick..... 6
Lamb's quarters..... 7	Lamb's quarters..... 5	Lamb's quarters..... 8
Black bindweed..... 4	Black bindweed..... 1	
Dandelion..... 2		
Canada thistle..... 1		
Total..... 33	Total..... 20	Total..... 20

The prevalence of weed seeds at the three depths in this field is practically constant, while a square yard of the surface inch contains about 4,984 weed seeds. It is significant that this field, which has been under a good system of cultivation, contains only about a quarter as many weed seeds as either of the two other fields mentioned.

Examination of samples taken from a spot along a road fence at Rouleau, Sask., shows how seeds may be spread by the wind. Weeds had been blown across a prairie field and lodged against the fence. The following seeds were found in the samples taken:—

Weed seeds in 6 oz. of surface soil	Weed seeds in 6 oz. of soil 2 to 3 inches deep	Weed seeds in 6 oz. of soil 5 to 7 inches deep
Stickseed..... 330	Stickseed..... 3	Lamb's quarters..... 6
Wild mustard..... 267	Black bindweed..... 5	
Hare's ear mustard..... 99	Chickweed..... 3	
Stinkweed..... 3		
Black bindweed..... 159		
Lamb's quarters..... 15		
Rye grass..... 12		
Pigweed..... 9		
Milk spurge..... 9		
Wall-flower..... 3		
Total..... 906	Total..... 11	Total..... 6

These results indicate that a large number of weed seeds of many kinds had been carried to this spot and show that the wind is an important factor in spreading weeds, especially on the prairie.

Germination of Weed Seeds

The seeds of most annual weeds, when embedded in the soil, retain their vitality for several years. The seeds of the Mustard family and others, when ploughed down soon after ripening, seldom germinate the following year or until they are brought by further cultivation near the surface. Light surface cultivation during the early autumn usually serves to stimulate germination in freshly ripened weed seeds and a considerable proportion of them may thus be destroyed, whereas by deep ploughing the difficulty is simply deferred to succeeding years.

The germination of weeds, as well as other seeds, is affected by heat. Many kinds of weed seeds, such as some of the grasses and mustards, will germinate

in the late autumn or early spring when the soil is quite cold. Others, such as wild buckwheat and lamb's quarters, require a warmer soil, and the seeds of foxtail and purslane continue dormant until stimulated by the heat of summer. Late autumn or early spring cultivation is not effective in destroying the seeds of weeds that will not germinate unless the soil is quite warm.

Weed Seeds in Seed Grain

One of the principal reasons why weeds are not brought under better control on farm lands is because such large numbers of their seeds are put into the soil through lack of care in ordinary farm operations. The use of seed grain that has not been well cleaned is responsible for the introduction of many new weeds and the increase of those already in the land.

Selection and preparation of seed is a task to which farmers must needs give considerable attention each year. It is an excellent practice to allot a suitable acreage of summer-fallow or of clover or grass sod for seed production, and at threshing time to set aside for seed purposes grain from the best and cleanest portion of the general crop. Time spent in roguing, or pulling out the most troublesome weeds from that part of the crop intended for seed production, is profitably employed.

Grain grown from good seed is cleaner, heavier and more uniform, and therefore in yield, grade and price gives better returns than grain grown from inferior seed. No expenditure in production of crops gives as large a profit from so small an outlay as does good seed. Clean summer-fallowing and other methods of combating weeds fall short of the desired result if dirty and inferior seed is used.

Despite the fact that practically at all times growers may produce or procure good seed, it has been shown from seed drill surveys and other investigational work that, while many farmers are exercising care in the selection and cleaning of their seed, there are many more who give less attention to this important subject than it rightly deserves.

The so-called seed drill survey is the taking of samples of grain, clover and grass seed being sown by representative farmers in a community or township, and submitting these for analysis to determine the weed seed content and quality of the seed in general use.

The following summary statements are from the more recent reports of seed drill surveys conducted in the various provinces. The samples shown as analysed in some provinces represent only one seed drill survey, while for other provinces the figures are for total seed drill survey samples analysed over two or more years. The samples taken were principally cereals, but included also some other field crops and some clovers and grasses. The grade classification of the samples is according to the standards under the Seeds Act.

In Prince Edward Island of 1,044 samples analysed 9 per cent were No. 1, 7 per cent No. 2, 16 per cent No. 3, and 68 per cent rejected. Couch grass and perennial sow thistle were the most common impurities in all the kinds analysed, which included wheat, oats, barley, and mixed grain.

In Nova Scotia of 1,009 samples analysed 26 per cent were No. 1, 8 per cent No. 2, 13 per cent No. 3, and 53 per cent rejected. Couch grass was the most common impurity in the oats, which comprised the majority of the samples analysed.

In New Brunswick of 109 samples analysed 23 per cent were No. 1, 11 per cent No. 2, 9 per cent No. 3, and 57 per cent rejected. The most common impurities in the oat samples, which comprised the bulk of the samples analysed, were couch grass and wild oats.

In Quebec of 737 samples analysed 11 per cent were No. 1, 2 per cent No. 2, 10 per cent No. 3, and 77 per cent rejected. The average number of weed seed per pound was 469, 92 of which were noxious. The most prevalent noxious impurities were wild mustard and ragweed.

Two comparative seed drill surveys conducted among the same farmers in a township in Eastern Ontario in 1926 and 1930, for the purpose of determining the benefits which accrue from the establishment of seed-cleaning centres equipped with modern cleaning machinery operated by electric or other power, revealed a gratifying improvement during the intervening four years in the quality of the seed used. Of the 179 samples taken in 1926, 18.4 per cent graded No. 1, 5.3 per cent No. 2, 35.6 per cent No. 3, and 40.7 per cent rejected. Of the 171 samples taken in 1930, 33.9 per cent graded No. 1, 7.5 per cent No. 2, 23.9 per cent No. 3, and 34.7 per cent rejected. The superior results from seed cleaning performed at central cleaning plants as compared with results from home fanning mills, as the latter are usually operated, are apparent from the following comparison based on investigation in Eastern Ontario in 1930: Of the samples cleaned at the cleaning plants 66.6 per cent graded No. 1, 6.6 per cent No. 2, and 26.8 per cent No. 3; while of those cleaned by home fanning mills 22.2 per cent graded No. 1, 7.8 per cent No. 2, 23.8 per cent No. 3, and 46.2 per cent rejected.

In Western Ontario of 785 samples of unmixed cereals tested 47.4 per cent were No. 1, 10 per cent No. 2, 21 per cent No. 3, and 21.6 per cent rejected. One sample of barley had a total of 5,800 weed seeds to the pound, of which 2,864 were noxious, and sowing this grain at the ordinary rate of seeding would plant approximately 400,000 weed seeds to the acre. All samples of cereals which contained more than 300 seeds of other cultivated kinds per pound were listed as "mixed grain." These mixed grain samples numbered 1,157 and from the standpoint of weed seed content analysed as follows: 36 per cent No. 1, 10 per cent No. 2, 25 per cent No. 3, and 29 per cent rejected.

In Manitoba of 1,007 samples analysed 8 per cent were No. 1, 8 per cent No. 2, 17 per cent No. 3, and 67 per cent rejected. The most prevalent impurities were wild oats, ragweed, stinkweed, couch grass, mild mustard and ball mustard.

In Saskatchewan in 1927 a seed drill survey was performed in a district comprising seven municipalities. Between 1927 and 1931 municipal seed-cleaning plants were established in the same area and in 1931 another seed drill survey was made, the results of which, when compared with those of the former survey, again emphasized the value of improved power cleaning machinery for improving the quality of the seed used in a community. Of the 917 samples taken in 1927 only 34.6 per cent had less than ten weed seeds to the pound, while of the 235 samples taken in 1931, 66 per cent had less than ten weed seeds per pound. In the 1931 survey 137 of the samples taken had been cleaned at central cleaning plants and of these 87.9 per cent had fewer than ten weed seeds per pound.

In Alberta of 1,225 samples of cereals analysed 13.3 per cent were No. 1, 15.4 per cent No. 2, 22.3 per cent No. 3, and 49 per cent rejected. The wheat samples average 59 other cultivated seeds and 130 weed seeds, including 25 noxious, per pound; the oat samples average 167 other cultivated seeds and 204 weed seeds, including 26 noxious per pound; and the barley samples averaged 434 other cultivated seeds and 423 weed seeds, including 74 noxious per pound.

In British Columbia of 322 samples of seeds of cereals analysed 13.4 per cent were No. 1, 20.2 per cent No. 2, 17.1 per cent No. 3, and 49.3 per cent rejected. The most common impurities were wild oats, ball mustard, tumbling mustard, stinkweed, and Canada thistle.

Weed Seeds in Grasses and Clover

Weed seed impurities vary naturally with the origin of the seed, but those found in Canadian-grown clovers and grasses are largely represented in the following lists.

Alfalfa Seed.—*Primary and Secondary Noxious.* Wild mustard, bladder campion, docks, catchfly, couch grass, ribgrass, Canada thistle, Russian thistle, chicory, ragweed, wild carrot, field peppergrass. *Others.* Black medick, green foxtail, sweet clover, lamb's quarters, lady's thumb, smartweed, sheep sorrel, mayweed, catnip, plantain, yellow foxtail, knotweed.

Red Clover Seed.—*Primary and Secondary Noxious.* Wild mustard, bladder campion, white cockle, ragweed, chicory, catchfly, ribgrass, docks, Canada thistle, couch grass, wild carrot, false flax, stickseed, field peppergrass. *Others.* Green foxtail, black medick, sweet clover, lamb's quarters, pale and common plantain, lady's thumb, barnyard grass, sheep sorrel, mayweed, knotweed, crabgrass, bedstraw, pigweed, witchgrass.

Alsike Seed.—*Primary and Secondary Noxious.* Bladder campion, catchfly, false flax, ribgrass, docks, Canada thistle, field peppergrass. *Others.* Black medick, sheep sorrel, sweet clover, lamb's quarters, chickweed, green foxtail, mayweed, pale and common plantain, cinquefoil, wormseed mustard, heal-all, shepherd's purse, pigweed.

Timothy Seed.—*Primary and Secondary Noxious.* Ox-eye daisy, bladder campion, Canada thistle, ribgrass, docks, catchfly, false flax. *Others.* Cinquefoil, common plantain, wormseed mustard, chickweed, sheep sorrel, lamb's quarters, green foxtail, sedges, sweet clover, pale plantain, mayweed, shepherd's purse, peppergrass, lady's thumb, evening primrose, yarrow.

Brome and Western Rye Grass Seed.—*Secondary Noxious.* Stickseed, stinkweed. *Others.* Lamb's quarters, tansy mustard, Russian pigweed, wild barley, wild oats.

Crested Wheat Grass Seed.—*Primary and Secondary Noxious.* Wild mustard, quack grass, stinkweed. *Others.* French weed.

Even with the greatest care and the best cultivation some weeds are almost sure to appear in crops intended for seed and the only practical means of handling them successfully is hand pulling or spudding. With clover seed crops especially it is essential that the fields be carefully gone over and the weeds removed or destroyed before they go to seed. Failure to do this often results in the production of seed that is badly contaminated with weed seeds and its market value is thereby greatly reduced or entirely destroyed.

Weed Seeds in Commercial Grain, Screenings, and Feeds

The Canada Grain Act allows No. 2 Canada Western White Oats to contain 1 per cent of small weed seeds with 2 per cent of wild oats, and allows No. 3 Canada Western Barley to contain $1\frac{1}{2}$ per cent of small weed seeds with 6 per cent of wild oats. Analysis of five samples of No. 2 Canada Western White Oats taken from shipments from five terminal elevators at Fort William showed the oats to contain an average of 313 noxious weed seeds per pound, including nine species, and a much larger variety and number of other weed seeds. This illustrates the grave danger in using such commercial grain for seed, and in addition to the weed content there are the two further objections that such grain may germinate poorly as a result of being frosted, and be a mixture of varieties which mature at different dates.

Practically all the wheat, flax, and rye, and a large proportion of the oats and barley, which enter the terminal elevators at Fort William—Port Arthur pass through the cleaners before being re-shipped eastward by lake or rail. In the process of this cleaning, from $1\frac{1}{2}$ per cent to $2\frac{1}{2}$ per cent of the total grain received, or an annual average of about 200,000 tons, is screened out. The "original" or "elevator" screenings vary widely in composition, depending on the kind of grain cleaned and the place of growth, together with seasonal, climatic, and soil conditions of the locality. They may contain from 30 per cent to 65 per cent of weed seeds having a certain feeding value, and from 10 per cent to 55 per cent of small weed seeds and chaff. An average of five representative samples of elevator screenings contained the following: Broken and Shrunken Wheat, Oats, Barley, Rye, and Flax, 21.6 per cent; Wild Oats, 7.8 per cent; Wild Buckwheat, 12.7 per cent; Cruciferous seeds including wild mustard, ball mustard, hare's ear mustard, tumbling mustard, tansy mustard, wormseed mustard, stinkweed, peppergrass, shepherd's purse, and false flax, 21.5 per cent; lamb's quarters and other seeds, 9.7 per cent; and chaff 26.7 per cent. To reclaim as much of the grain as possible, the screenings are recleaned, and at the same time are separated into at least three classes: No. 1 Feed Screenings, Mixed Feed Oats, and Refuse Screenings.

No. 1 Feed Screenings are readily marketable in Canada for use in the feeding of live stock. They are sold under certificate issued by authority of the Board of Grain Commissioners, and in such case must contain not more than 3 per cent small weed seeds, not more than 5 per cent ball mustard, not more than 6 per cent small weed seeds and ball mustard combined, not more than 3 per cent chaff and dust, and not more than 8 per cent wild oats. To destroy the vitality of these small seeds and thus prevent their dispersal as noxious weeds throughout the country it is essential that the screenings be thoroughly pulverized before feeding. In many mills improved grinders are used which leave few or no vital weed seeds in the ground product, but it is not possible to do this with the ordinary grain chopper used on the farm. The hammer mills now being made for farm use will do this work satisfactorily. Samples of No. 1 Feed Screenings contain broken and shrunken wheat, 25 per cent to 75 per cent; wild buckwheat, 20 per cent to 70 per cent; oats, barley, flax, and rye, nil to 6 per cent; wild oats, nil to 8 per cent; cruciferous seeds, including wild mustard, Indian mustard, hare's ear mustard, stinkweed, tumbling mustard, wormseed mustard, and false flax, nil to 2 per cent; other weed seeds, 1 per cent to 6 per cent; and chaff $1\frac{1}{2}$ per cent to 3 per cent.

Mixed feed oats are recovered by a special cleaner of the indented disc type and contain an average of 75 per cent of wild oats. When sold under inspection certificate they consist of wild oats and false wild oats with small proportions of oats, barley, rye, and wheat. In using this product it must be remembered that crushing does not destroy the germ of a great many of the wild oat seeds.

Refuse screenings are the residue after the No. 1 feed screenings, and the mixed feed oats are removed, and consist principally of the smaller weed seeds with chaff, dust, and other foreign material from the original screenings. In the past they were practically all exported to the United States, and shipments have reached as high as 120,000 tons annually. In Canada a relatively small quantity is sold for further recleaning, or for feeding, in restricted enclosures, to cattle and sheep. In years of low export demand several thousand tons are burned in power plants in Northwest Ontario.

Mill screenings, material cleaned from wheat in the process of milling flour, are required by the Feeding Stuffs Act to contain not more than 8 per cent of fibre and not more than 5 vital weed seeds per ounce. This class of screenings will vary quite widely in quality, depending upon the character of the wheat being milled and the efficiency of the cleaning machinery.

Screenings are used to some extent in the manufacture of Registered Commercial Mixed Feeds, and also as a filler in certain stock and poultry tonics commonly appearing on the market. Nevertheless it should not be forgotten that screenings are at best an unnecessary by-product, and that every effort should be made throughout the country to produce grain free from weed seeds and thereby lessen their annual output at the elevators and mills.

The need for thoroughly grinding such feeds as screenings, before feeding, is evident from the results of an experiment* carried out at the Maryland Experiment Station. A cow and horse were each fed two pounds of the unground grain screenings with middlings, bran and wheat straw, each morning and night for seven days. On the evening of the seventh day the animals were bedded with sawdust and the dung of one night collected. The sawdust and dung were thoroughly mixed and put in boxes and set on a bench in the greenhouse. The dung was collected on May 24. On June 21, the following weeds had grown:—

Cow Dung—

- 149 Lamb's quarters.
- 12 Pigweed.
- 14 Bindweed.
- 4 Foxtail.
- 2 Timothy

Horse Dung—

- 1,213 Lamb's quarters.
- 28 Foxtail.
- 11 Pigweed.
- 12 Bindweed.
- 6 Timothy.
- 3 Clover.
- 2 Morning glory.
- 5 Mustard.

Poisonous or Deleterious Effects of Certain Weed Seeds

Investigation has shown that many of the complaints made by live stock men in regard to the injury to the health of animals caused by certain feeding stuffs is due to the presence of poisonous or otherwise injurious weed seeds in the feed. Sometimes animals refuse to eat feeds and the trouble is often traceable to the presence of seeds which are bitter or otherwise disagreeable in taste. Comparatively little work has been done in this connection but the following seeds are authoritatively stated to be poisonous: Wild mustard, black mustard, worm seed mustard, penny cress, tumbling mustard, purple cockle and false flax. The following are also objectionable in feed on account of injurious properties or disagreeable taste: darnel, cow cockle, blue bur, hare's ear mustard, wild radish and ergotized grains.

WEED CLASSIFICATION AND SEED GRADES UNDER THE SEEDS ACT

The Seeds Act, 1923, empowers the Governor in Council to specify the weeds that are to be classed "primary noxious," "secondary noxious" and "other weeds" within the meaning of the Act. This makes it possible to include any new weeds in any of the classes or make transfers from one class to another as required without amending the Act. Such changes become necessary from time to time. It should be remembered that some weeds, while noxious from an agricultural standpoint, are not classed as noxious under the Seeds Act because their seeds seldom, if ever, occur in commercial samples, or because their seeds are very fine and are easily separated from grain or other coarse seed. It is believed to be impracticable and undesirable to legislate in a drastic manner against more than 25 or 30 of the most troublesome kinds commonly disseminated in commercial seeds. Noxious weeds that might very well be included in a provincial law having for its object the suppression of weeds growing on farm lands might differ materially from those embodied in a law to restrict their

* Bull. 168. Maryland Agri. Exp. Station. "By-Product Feeds." 1912.

distribution in commercial seeds. Many kinds of weeds become disseminated by wind, water and other natural agencies, the seeds of which seldom occur in grass or clover seed or in seed grain.

The ability of weeds to persist in cultivated crops due to the long period in which their seeds may lie dormant in the soil or owing to their determined growth by virtue of running root stalks, is the principal reason for classifying them as noxious.

There are a great many weeds other than those classed as noxious under the Act the seeds of which occur in commercial samples. Over two hundred different species of weed seeds are found in the samples analysed for seed merchants and farmers during one year. Many of these are seeds of plants that are of only secondary importance as weeds and occur very seldom. Others are common impurities but not sufficiently dangerous to be classed noxious.

The three groups into which weeds are classified under the Seeds Act are:—

- (1) Primary noxious, the eleven members of which are couch grass, bladder campion, dodder, field bindweed, Johnson grass, ox-eye daisy, perennial sow thistle, white cockle, wild mustard, red cockle and leafy spurge. Hoary cress is now (1935) being considered for addition to the primary noxious list.
- (2) Secondary noxious: ball mustard, blue weed, Canada thistle, chicory, field peppergrass, cow cockle, dandelion, docks, false flax, forked catchfly, hare's ear mustard, night-flowering catchfly, purple cockle, ragweed (common), ragweed (great), ragweed (perennial), ribgrass, Russian knapweed, Russian thistle, stickseed, stinkweed, tumbling mustard, wild carrot, wild oats and wild radish.
- (3) Other Weeds. This group contains the long list of lesser weeds such as catnip, lamb's quarters, cinquefoils, etc.

No. 1 and No. 2 grades for seed of cereals and other field crops allow no seeds of primary noxious weeds, while No. 3 grade allows not more than 5 primary noxious weed seeds, 15 primary or secondary noxious weed seeds combined, 100 weed seeds of all kinds and 300 seeds of other cultivated plants per pound.

No. 1 grade for seed of clovers and grasses allows no seeds of primary noxious weeds. No. 2 grade allows not more than 5 primary noxious weed seeds per ounce, and 20 primary and secondary noxious weed seeds combined per ounce with certain specific exceptions, while No. 3 grade allows not more than 25 primary noxious weed seeds, 80 primary and secondary noxious weed seeds combined and a total of 500 weed seeds per ounce, with certain specific exceptions.

WEED CLASSIFICATION ACCORDING TO LONGEVITY AND GENERAL METHODS OF ERADICATION

Weeds are classified according to the length of time they live, as annuals, or one-year plants; winter annuals and biennials, or two-year plants, and perennials, or many-year plants. In eradicating weeds it is of the greatest importance to ascertain under which of these heads they come.

Annuals

Annuals complete their growth in one season. As a rule they have extensive, mostly fibrous, roots and produce a large quantity of seeds. Annual weeds usually are scattered more or less thickly among the crop plants and seldom take complete possession of the land. Due to this fact they are less conspicuous and alarming than small but solid patches of perennial weeds and for this reason annuals are sometimes regarded as being less serious pests than perennials. Without

minimizing the danger from perennials it may be said that annuals constitute a more serious problem, especially in areas naturally restricted to grain farming. The heavy losses in crops each year owing to wild oats infestation in Canada generally, and to wild mustard, Russian thistle and stinkweed infestation over vast portions of the Prairie Provinces is sufficient evidence of the seriousness of annual weeds.

According to recent information on the eradication of the most common and serious perennial pests such as quack grass, perennial sow thistle and Canada thistle, it is known that these weeds can be entirely exterminated from the land in one season if properly attacked by the so-called shallow cultivation method described in connection with perennial weeds. There is no such method, however, by means of which the land can be cleaned of annual weeds in a single year. The eradication of annual weeds is usually a lengthy undertaking, owing to the long periods through which many kinds of seeds will retain their vitality while lying in the ground. These weeds, however, may be eradicated from land in a course of several years, regardless of the intensity of infestation, through a method known as "green summerfallow method" for controlling wild oats and other annual weeds. The method essentially consists of shallow tillage operations, tending to provide the best possible conditions for germination of weed seeds in the ground, and then destroying the young weed plants before they mature new seeds. The procedure is as follows:—

(1) *Crop Year.* Soon after harvest, plow or disk the infested field to a depth not greater than three inches, harrow and pack the surface immediately. This is to stimulate the germination of annual weed seeds in the fall. The resulting plants will be killed out by frost in winter.

(2) *Summerfallow Year.* In the spring of the summerfallow year, leave the land undisturbed until the surface is well covered with the annual weeds, in the case of wild oats allowing them to grow to about five inches in height. At this stage, destroy the plants by surface cultivation and three days later harrow and pack the land firmly. Under moderate moisture conditions in about one month's time another heavy crop of weed plants will emerge. When it attains a fairly dense stand and is about five inches high, destroy it also by surface cultivation. By repeating these operations throughout the summerfallow season, from three to five crops of the weed plants may be killed, providing the moisture conditions are average.

(3) *Crop Year After Summerfallow.* It is customary to seed summerfallowed fields to wheat as a cash crop. If the weed infestation is still severe, it is advisable, however, to seed such land to barley. Some of the annual weed seeds will germinate in the growing crop but the resulting plants will be smothered at the early seedling stage before maturing seeds. In addition, some of the dormant seeds remaining in the soil will deteriorate during this long period and lose their vitality.

(4) *Second Green Summerfallow.* Most of the remaining annual weed seeds will be destroyed during the second green summerfallow and the land will be reasonably clean and suitable for continuing in a regular crop rotation with wheat after summerfallow and barley, oats or wheat, as the second crop.

In this method satisfactory results may not be obtained if packing is omitted. For light soils, heavy cylindrical packers should be used, but for heavier soils a harrowing with the teeth set back at an angle is frequently sufficient. Complete destruction of the original stand of weed plants is also important.

Miscellaneous Recommendations for Controlling Annual Weeds

Since the annual weed seeds, particularly those of wild oats, may be spread over clean land by many agencies, all reasonable means should be used to guard against this happening. Following are the principal points to keep in mind:—

(1) Use only as clean seed as it is possible to obtain.

(2) Clean the racks, wagons, drills and separators from weed seeds when going into the field.

(3) Feed animals only with properly crushed grain.

(4) Do not haul manure to the field before it has been sufficiently rotted. The rotting usually kills the weed seeds.

(5) Practice heavier rates of seeding on the land badly infested with annual weeds.

(6) In districts suitable for fall rye, this crop may be used for controlling both wild oats and the other annual weeds. Winter rye being established in the fall makes an early start in the spring and gives annual weed seedlings very little opportunity to become established.

(7) Partial control of wild oats, as well as the other annual weeds, may be obtained by seeding weedy fields to oats for green feed. In this case, however, it is necessary to cut the hay not later than at heading, otherwise the wild oat plants will produce germinable seeds.

(8) Practise shallow fall plowing or discing with immediate packing soon after harvest in every case where annual weeds are to be controlled.

(9) When a spring sown crop is used for controlling annual weeds, it is advisable to delay seeding until the field is thickly covered with the weed plants. These should be destroyed, while preparing the field for seeding.

(10) Hay crops, cut while green, are very effective for controlling wild oats and other annual weeds. A good uniform stand of crop is essential, as otherwise the weeds take possession of the vacant spaces. Perennial hay crops seeded down for three or four years have the effect of greatly reducing the amount of viable weed seeds in the ground.

(11) Sheep and other livestock help materially in controlling annual weeds.

(12) A number of weeds may be controlled economically by the use of certain chemicals. A four to five per cent sulphuric acid solution has been used effectively on wild mustard and stinkweed in heavily infested fields.

Biennials

Biennials require two seasons to complete their growth, the first being spent in collecting and storing up a supply of nourishment which is used the second season in producing flowers and seeds. Some weeds, called winter annuals, are true annuals when the seed germinates in spring, but if the seed germinates in the fall the resulting plants winter over and complete their growth in the second season and are, therefore, biennials in character and require practically the same methods of control as do the regular biennials.

The weeds of this group are more harmful to cultivated crops than is generally recognized. Biennials germinating in spring along with the sown crop seldom do appreciable damage as their small rosettes are mostly smothered or badly depressed by the cultivated plants. If the biennials or winter annual weeds, however, germinate in the fall and winter over, they become extremely dangerous pests in the spring sown grain crops. The reason for this is that in the spring they are found in the fields as small and innocent-looking plants which are easily missed in great numbers by the cultivation before seeding. Such plants, though small, have well-developed root systems and are capable of re-establishing themselves before the crop emerges, and growing ahead of the cultivated plants they crowd them out and mature a multiple of new seeds very early in the season.

The most effective method for controlling these weeds consists of the fall shallow cultivation soon after harvest with immediate packing of the soil. This induces germination of the weed seeds in the fall. The next spring every care should be taken to destroy the young weed seedling while preparing the land for seeding. On the summerfallowed fields the weeds should be destroyed from

time to time in order to prevent the plants from maturing. If these operations are properly done during a period of several years the weeds disappear altogether as they have no chance to produce new seeds.

Perennials

Perennials are those plants which continue to grow for many years. As a rule they propagate both by seed and by perennial underground organs called "rootstocks". Perennials have two distinct modes of growth; some root deeply, while others have the root system near the surface. The most troublesome are those which extend long underground stems or rootstocks beneath the surface of the ground, as Canada thistle, perennial or field sow thistle, field bindweed, poverty weed, hoary cress, leafy spurge, toad flax and bladder campion. Representatives of the second class or shallow-rooted perennials are pasture sage, yarrow, couch grass and sweet grass. With respect to their lateral spreading, perennials can also be divided into two different groups. The first one is characterized by the underground creeping roots extending long distances in a short time, while in the other group these extend but slowly from the root by short stems or offsets. Of these, ox-eye daisy, dandelion, goldenrod and yarrow are examples. Disregarding these differences they have in common one important feature; they usually occupy the ground so thoroughly that none, or only occasional plants of other kinds can thrive among them. Fortunately, in the majority of cases they are found in patches and the total acreage of cultivated land possessed by perennial weeds is small as compared with that polluted by annuals. It is true that perennials are dangerous pests, yet considering the comparatively small acreage under their infestation, together with the fact that they may be completely eradicated from the land in one season by cultural treatment, it may reasonably be said that they are only of secondary importance to annual weeds.

The most serious perennial weeds such as perennial sow thistle, Canada thistle, quack grass, toad flax and many others can be completely eradicated from a field in one season by the so-called "shallow cultivation method". This eradication method is based upon the fact that approximately 90 per cent of the dry matter of a plant is made up of products containing carbon dioxide which the plant takes from the air through the surfaces of its green leaves. If the plant is deprived of this main source of food material through prevention of top growth during a definite length of time, it finally dies from suffocation and starvation.

In attempting to achieve this task it is necessary to keep in mind the following points: (1) complete eradication of the weed; (2) reservation of soil moisture for the following crop; (3) prevention of soil drifting, particularly in the Prairie Provinces; (4) economy of time, labour and horsepower. All these objectives may be accomplished by very shallow tillage, sufficient to inhibit top growth. The procedure is simple and consists of the following operations: (1) The land infested with perennial sow thistle or quack grass should be plowed with sharp shares to a depth not greater than three inches and disked immediately to close the furrows; (2) the surface should be kept entirely free from top growth during the following 12 weeks in the case of perennial sow thistle, and during 16 to 18 weeks in the case of quack grass infestation, by using a sharp disk or duck-foot cultivator whenever new leaves begin to appear above the surface. With quack grass, much oftener than with other perennial weeds, difficulty arises in wet years, especially on heavier types of soil. Under such conditions the surface is sometimes too sticky to permit cultivation to be done on time. A delay in cultivation, on the other hand, results in green top growth which reinforces again the plants weakened by the previous treatment. This difficulty will occur, however, irrespective of the method used, but in most cases a careful farmer can keep his land free from top growth.

Canada thistle may be successfully eradicated in one year by the same method but the operations should be delayed until the end of July when the persistent undergrowth roots are most exhausted. From that time top growth should be entirely prevented until freezeup by shallow surface tillage with any farm implement available on the farm. If the recommendations are thoroughly carried out the roots of the weeds will die, irrespective of their depth of penetration.

This treatment does not disturb the deeper layers of soil, consequently the loss of moisture through evaporation is not encouraged and a larger supply is saved for the subsequent crop. Due to the fact that practically the whole of the dead root material is left in the ground the soil is enriched in organic matter and its structure improved. Because of this, and because only a very shallow layer of soil is affected by the cultivation, the danger of soil drifting is small. If the top layer is very susceptible to drifting, as is the case in many areas of the Prairie Provinces, the first ploughing after the treatment should be to a depth of five inches. This will bring to the surface a sufficient amount of compact clods of soil to prevent damage from drifting. The shallow cultivation method requires comparatively little pulling power and is therefore economical and suitable for use on a large scale. This method, when properly applied, results in the complete eradication of most of the perennial weeds. At the end of the treatment the land is good summer-fallow and may be used for any crop desired. Imperfect treatment, such as a single ploughing, often does more harm than good by breaking up the rootstocks and stimulating growth. The rootstocks of most perennial weeds are very persistent, and even small sections broken off by farm implements will quickly take root, send up new shoots and establish independent plants. Only persistent and thorough treatment will suffice to destroy them.

Summer-fallowing

The practice of summer-fallowing land, whatever may be said against it, affords the best opportunity to suppress noxious weeds. For lands foul with persistent growing weeds a suitable type of summer-fallow will usually be the most effective, and in the end the least expensive method of bringing the weeds under control and, frequently, of eradicating them. The amount and nature of the cultivation of a summer-fallow will depend on the habits of the weeds, the kind of soil and the climatic conditions.

A summer-fallow may be defined as unseeded land cultivated repeatedly for the purpose of reducing or exterminating the weed seeds and weed plants present. If this is achieved the moisture which otherwise would have been used up by a volunteer growth is retained in the soil. Because the weed growth consists of both annuals and perennials which require entirely different treatments for their eradication, a brief review is here given of the two types of summer-fallow.

Green Summer-fallow for Controlling Annual Weeds

Annuals are propagated nearly exclusively by seeds which they produce abundantly. Moreover, these seeds are usually capable of retaining their viability for several years lying under the surface of the soil. The only effective method, therefore, for destroying annuals is to give their seeds the best possible opportunity to germinate and then to kill the young plants before they mature new seeds. To accomplish this satisfactorily it frequently will be necessary to incorporate in the crop rotation system the green summer-fallow method already described under the heading "Annuals".

Black Summer-fallow for Eradication of Perennial Weeds by Shallow Cultivation Methods

Unlike the annuals, the persistency of perennial weeds depends mostly upon the vitality of their underground perennial rootstocks. These are very vigorous, penetrating deeply below the surface, and bearing numerous vegetative buds

capable of producing new plants. As the underground growth cannot be reached and destroyed directly by ordinary tillage the aim should be to prevent all growth above ground since, if no leaf growth is allowed to develop, the underground parts of the plants will be starved out and eventually die. To do this, deep tillage is not necessary as the top growth may be more easily, cheaply and quickly destroyed by a shallow cultivation as already described under the heading "Perennials". The only essential thing is to see that the surface of the summer-fallowed field is literally free from top growths during the time required. This method takes a few cultivations at short intervals at the beginning of the eradication work. As time proceeds, the intervals between separate cultivations become longer and longer, and often the total amount of cultivation required is not any greater than for ordinary summer-fallow.

Intertilled Crops

Under favourable conditions and on smaller farms, intertilled crops may be substituted for summer-fallow. In this practice, corn or grain is seeded in rows far enough apart to allow of thorough tillage during the early stages of growth. Good satisfaction in the eradication of weeds may only be expected, however, if annuals predominate. In cleaning land of perennial weeds intertilled crops cannot take the place of summer-fallow.

Short Rotation of Crops

To keep farms free from weeds, few methods give such good results as a systematic short rotation of crops, with regular seeding down to grass or clover at short intervals. Weeds are most in evidence in districts where the production of cereal grains predominates and where the systematic alternation of crops is not generally practised. Thorough cultivation with a systematic rotation of crops, combined with the maintenance of as many sheep as can be kept to advantage, is a certain and profitable means of keeping weeds under control.

Seeding to Grass

Lands foul with some kinds of weeds, particularly annuals, may advantageously be seeded to grass for hay or pasture. The cultivation of hoed crops becomes too expensive for labour when the soil is polluted with weed seeds. Grain crops may also be unprofitable because of weeds, and they afford an opportunity for the weeds to increase. Seeding to grass and cutting the hay crops early will prevent most kinds of weeds from ripening more than a relatively small number of seeds, and the number of vital weed seeds in the sub-surface soil will rapidly decrease from year to year. If perennial weeds are also prevalent, it would be well to pasture with sheep and mow the roughage closely each year before the spring growth has formed seeds.

Farm Implements to Destroy Weeds

The best time to destroy weeds is within two or three days after the first pair of leaves has formed on the seeding plant. In friable soils the "weeder" is a useful implement for that purpose. The "tilting" harrow is also satisfactory for comparatively loose soils and is preferred as a weed destroyer on firm or clayey land. Weeds are irregular in time of germination; consequently it is necessary to apply the weeder or harrow frequently throughout the growing season. Potatoes, or fields of corn and cereal grains when sown with a drill, may advantageously be treated with such weed destroyers once or twice before the crop distinctly shows above the ground, and again, with corn and ordinary grain crops, when the plants are three to six inches high. Even relatively heavy harrows ordinarily in use will do little damage to the potatoes, corn or grain plants if the land is not wet, and the loosening of the surface soil benefits the crop in addition to the destruction of the weeds.

For perennial weeds or seedlings that have become well rooted, a cultivator having diamond shaped or other relatively broad shares is needed for hoed crops. The disk is a favoured implement for destroying weeds in a summer-fallow or in preparing a seed bed. When, however, it is desired to unearth and remove the rootstocks of perennial weeds such as couch grass, a narrow-toothed cultivator that will loosen the soil and bring the underground vegetation to the surface is preferred to an implement that will cut the rootstocks, the small cuttings of which may be exceedingly persistent in growth.

Making Weed Seed Collections in Schools

No subject in agriculture is better adapted for presentation to school children than the study of seeds. The collection, identification and study of seeds give scope for the training of a wide range of faculties and the information so derived is of real value to any one engaged in crop production. It is, therefore, advisable that those responsible for directing children in collecting and studying seeds should understand the seeds it is most important to know, and their relationship to the different branches of crop production.

Unfortunately, it is not difficult to make a fairly large and representative collection of weed seeds in almost any district in Canada. There are a number of weeds which occur practically everywhere. On the other hand, a great many weeds are associated with certain crops, or with certain types of soil, or are limited to particular sections of the country. The weed seeds which may be found in almost any district include lamb's quarters (*Chenopodium album* L.), wild buckwheat (*Polygonum Convulvulus* L.), wild oats (*Avena fatua* L.) and wild mustard (*Brassica arvensis* (L.) Ktze.).

CLEANING SEED

Improper cleaning of seed is in most cases due to lack of the necessary riddles and screens, or to the mill not being properly regulated. Any good fanning mill in which thorough control over the air blast is obtained, and in which a series of riddles and screens* may be adjusted at will, can be fitted and operated to do fairly good work.

It is difficult to give instructions for fitting and operating a mill which will apply in all cases, as different samples of the same kind of seed may require different treatment, even in the same mill. On the other hand, the same sample of seed would require different combinations of sieves in different mills, depending on the length and slope of the sieves, the direction and violence of the shake, the strength of the air blast and the way in which it strikes the seed, and the rate at which the grain is passed over the sieves.

Importance of the Air Blast

The Air Blast in a fanning mill is intended to remove as much as possible of the lighter material without unnecessary waste of plump seed. This is the only way of taking out some impurities which, on account of their size, cannot be separated by sieves. The work of the air blast is of double importance on account of the fact that the removal of the light material assists the sieves by (1) removing part of the grain that would otherwise have to go through them; (2) preventing them from becoming clogged by this light material. In some mills this fact is taken into account when the air blast is increased, by automatically decreasing the shake of the sieves. The air blast is not strong enough unless a few good seeds are being blown out with the chaff.

Sieves—Description and Numbers

Fanning mill sieves are of two general types, those made of perforated zinc and those made of woven wire. Perforated zinc sieving has either round (figs. 2,

* As used in this article the word *riddle* refers to the upper sieve, and *screen* to the lower sieve. The word *sieve* is applied indiscriminately to either or both.

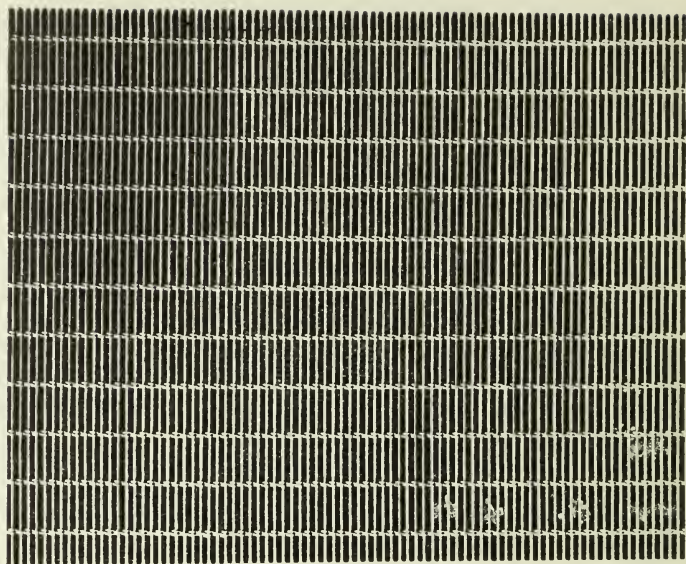


FIG. 1.—Four by twenty-four woven wire sieve, contains four wires to the inch one way and twenty-four the other, the type of screen used in cleaning red clover seed. Shrunken clover seeds, ribgrass, and the smaller weed seeds pass through the oblong opening while the plump seed remains above.

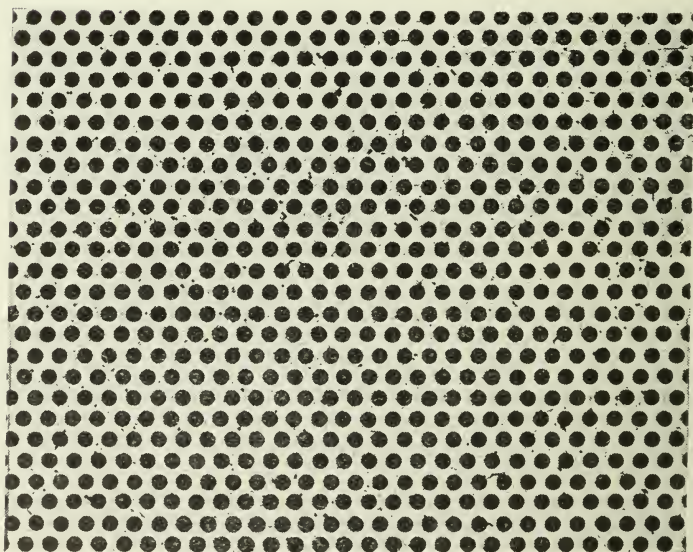


FIG. 2.—One-fifteenth-inch perforated zinc sieve—perforations $\frac{1}{15}$ -inch in diameter, used as a riddle or upper sieve for cleaning red clover.

3 and 5), oblong (fig. 8), or triangular (fig. 9) perforations. There are square (figs. 4 and 6) and long-mesh (figs. 1 and 7) woven wire sieves.

The diameter of the perforations in zinc sieves is usually given in sixty-fourths of an inch. For example, an "8" sieve usually means one with perforations $\frac{8}{64}$ of an inch in diameter. The next smaller and larger sizes are $\frac{7}{64}$ and $\frac{9}{64}$, respectively, although half sizes sometimes occur. A similar system is used for the triangular and oblong perforations.

The mesh of woven wire is usually expressed by giving the number of wires to the inch each way; thus an 8 by 8 woven wire is one made of eight wires to the inch each way; a 2 by 10 contains two wires to the inch one way and ten the other. The size of the opening will vary with the diameter of the wire used.

The number which manufacturers put on the various sieves supplied with their mills often has no reference to the size of the perforation or mesh of the woven wire of which the sieve is made. For example, a sieve which a manufacturer designates as No. 12 may not be a $\frac{12}{64}$ perforated zinc or a 12 by 12 woven wire. It is not a difficult matter, however, to determine the size of the perforations or mesh of the woven wire cloth by means of a proper rule.

Cleaning Cereal Grains and Flax

It must be remembered that the sieves mentioned below are not recommended as the best or the only sieves for cleaning the various seeds in question. They are examples of the type of sieve most useful for the various purposes. The specific sieve required for cleaning any particular lot of seed depends upon a variety of factors as explained above.

In cleaning cereal grains for seed it is often advisable to remove from one-third to one-half of the total bulk. When grain is thus thoroughly cleaned, most of the weed seeds will be removed with the screenings. Some of the weed seeds are difficult to separate, but most of them can be removed by a good fanning mill if the proper sieves are at hand and sufficient time and pains are taken to determine the best combination of size and slope of sieves, shake, air blast, and rate at which the grain is passed over the sieves.

In cleaning cereals, especially wheat, attention should be given to the removal of the smut. Unbroken smut balls are impervious to the solutions used to destroy smut spores on the surface of the kernels.

Unless all smut balls are removed from a lot of wheat, the grain is liable to be reinfected by the breaking of a few of these, each of which contains millions of spores, thus rendering the labour of treating of no avail.

For ordinary grain cleaning, a large mesh woven wire sieve is usually employed as a topmost sieve to take out straws and the larger impurities which otherwise would clog the riddle and interfere with the separation it is intended to make.

Wheat

A zinc sieve with perforations about 12, 13 or 14 sixty-fourths of an inch in diameter is generally used as a riddle. Such impurities as oats will often slide the length of such a sieve and fall off behind, while wheat tips on end and falls through the perforations. A number of these riddles with the same or approximately the same perforation is often arranged one above another. By this means an oat or a *wild oat* falling through a perforation is started sliding again on the sieve below, and is ultimately run off behind.

Several types and sizes of sieves are used in the lower shoe for cleaning wheat. The $\frac{8}{64}$ or $\frac{9}{64}$ perforated zinc, 7 by 7, 8 by 8, and 9 by 9 square mesh woven wire, and the 2 by 9, 2 by 10, and 2 by 11 long mesh woven wire are all in use. In deciding which sieve to use, the kind of wheat, nature of impurities

and object of the cleaning—whether for seed or market—must be considered. The buckwheat screen (fig. 9) is sometimes used for the separation of *wild buckwheat* from wheat.

Barley

The cleaning of barley requires similar although not identical sieves to those used for wheat.

Oats

In cleaning oats the most important sieve is the lower one. The size of the opening, its slope and shake should be such as to get everything smaller than the plump oats to pass through. A useful sieve for this purpose is one made of zinc with oblong perforations (see fig. 8). The size of the openings to be used will vary with the kind of oats. The $\frac{5}{64}$ by $\frac{1}{2}$ may be taken as a standard. For very plump oats the $\frac{1}{12}$ by $\frac{1}{2}$ may be used. A $\frac{7}{64}$ by $\frac{3}{4}$ riddle is used for removing double oats.

Long mesh woven wire screens (fig. 7) are commonly used instead of the perforated zinc. Square mesh sieves are used also.

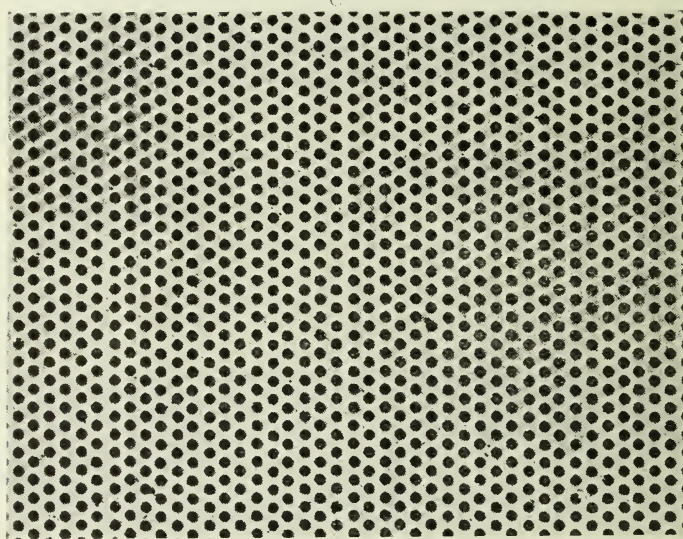


FIG. 3.—One-twenty-second-inch perforated zinc sieve—perforations $\frac{1}{2}$ -inch in diameter. When used as riddle with a short quick shake timothy passes through, leaving Canada thistle, chicory and seeds similar in size above to be run off the end. Success in making separations with any sieve depends on giving it the proper slope and movement. Since this is one of the finest riddles used in general cleaning, it is the most difficult to operate effectively.

Flax

Flax requires on top a woven wire sieve such as the 3 by 16, 4 by 16 or 4 by 14, or a $\frac{1}{16}$ by $\frac{1}{4}$ perforated zinc riddle, and a $\frac{1}{12}$ -inch perforated zinc screen below.

Cleaning Grass and Clover Seeds

The seeds of many of the weeds that grow in clover and grass seed crops ripen at the same time and are of such size that they are difficult or impossible to remove by sieves in an ordinary fanning mill.

Red Clover

A sample usually contains few weed seeds larger than the clover seed. *Ragweed*, if none of the outer hulls has been removed in threshing, should be separated from the clover by $\frac{1}{15}$ -inch perforated zinc riddle (fig. 2). Sticks, pieces of straw and anything larger than the clover run over this sieve.

A long mesh woven wire screen is better than one made of square mesh wire cloth for cleaning red clover seed. The 4 by 24 (fig. 1) is often employed for this purpose, but the exact mesh required will depend on the size of the clover seed and the kind of impurities to be removed. A long mesh sieve will hold all the good clover, allowing the small impurities to pass through. This sieve, assisted by the air blast, should take out practically all of the *pale plantain*, *much of the mayweed and lamb's quarters*, and many of the *ribgrass* as well as shrunk clover seeds. Besides the 4 by 24 sieve, the 4 by 25, 4 by 26, 4 by 28, 6 by 24, 6 by 28, etc., are also recommended as lower sieves for cleaning red clover, their efficiency depending upon the size of the seeds composing the sample.

The 22 by 22 woven wire screen is very useful in the lower shoe for taking out sheep sorrel and seeds only slightly smaller than the clover. In some cases the 20 by 20 or 18 by 18 may be required, but these will allow considerable of the smaller clover to pass through. A $\frac{3}{64}$ by $\frac{5}{16}$ is effective in removing wild mustard.

Hulled ragweed, docks, catchfly, foxtail, black medick, bladder campion, wild mustard and white cockle, are very near the size of clover and are impossible to remove by means of an ordinary fanning mill. Fields must be cleaned of these weeds before clover seed can be grown with profit.

Alfalfa and Sweet Clover

Most of the impurities common to red clover are common also to alfalfa and sweet clover with the exception of plantain and black medick, and as all three clovers are similar in size all three require similar sieves for cleaning.

Alsike

A zinc riddle with perforations $\frac{1}{18}$ -inch in diameter should remove weed seeds and other impurities larger than alsike, including *Canada thistle and docks*. This sieve is used above, the larger impurities being held and run off at the end while the alsike passes through. With this sieve the air blast should be carefully controlled in order to insure a good separation.

The 24 by 24 woven wire sieve used in the lower shoe, is one of the most useful sieves for cleaning alsike. It will improve the general quality of the sample by removing the small and immature alsike along with the smaller weed seeds—*chickweed, worm-seed mustard, plantain, shepherd's purse*, and seeds similar in size. These small materials pass through the 24 by 24 sieve while the plump alsike is held back.

Timothy

Weed seeds and other material larger than timothy are removed by a sieve which with the aid of the air blast will hold back the impurities and run them over the end of the sieve while the timothy passes through. A zinc sieve with

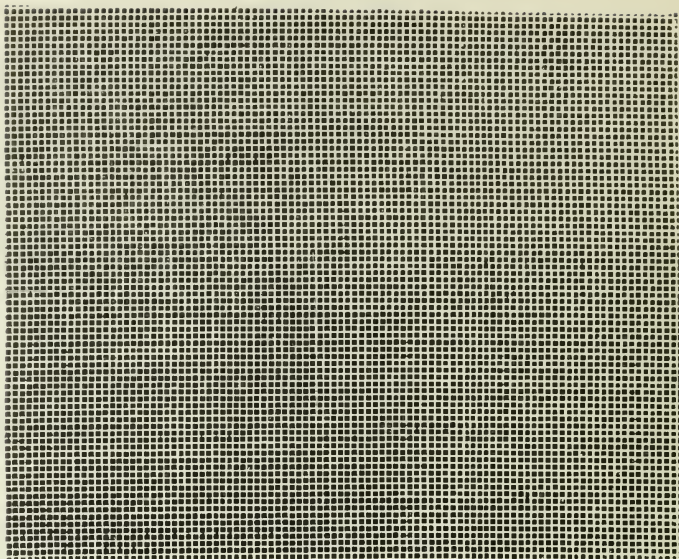


FIG. 4.—Twenty-eight by twenty-eight woven wire sieve—made of twenty-eight wires to the inch each way, a useful screen for removing small weed seeds such as chickweed, cinquetoil, plantain, shepherd's purse and worm-seed mustard from timothy. When the timothy is small a finer screen such as the 30 by 30 should be used. Sometimes screens made of long mesh wire cloth similar to that shown in fig. 1, only finer, are used for timothy seed. The 6 by 30, 6 by 36, 8 by 38, and 8 by 40 are used, but the last two or three are too fine for satisfactory work.

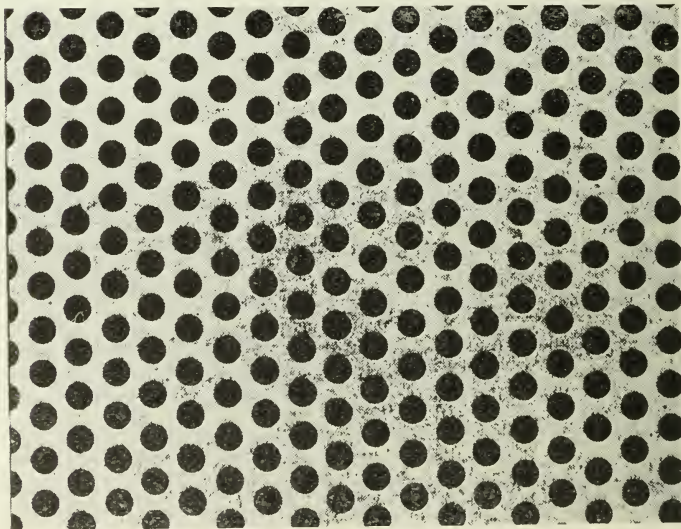


FIG. 5.—Sieving sometimes used as a screen for wheat, perforations $\frac{3}{4}$ -inch in diameter. This sieve will hold the plump wheat and permit small weed seeds and shrunken wheat to pass through. A sieve of this kind with larger perforations, about $1\frac{1}{4}$ (approximately $\frac{1}{2}$) inch in diameter, should be used as a riddle or upper sieve for wheat. Oats and other impurities larger than wheat should slide the length of such a sieve and fall off behind while the wheat kernels tip on end and fall through.

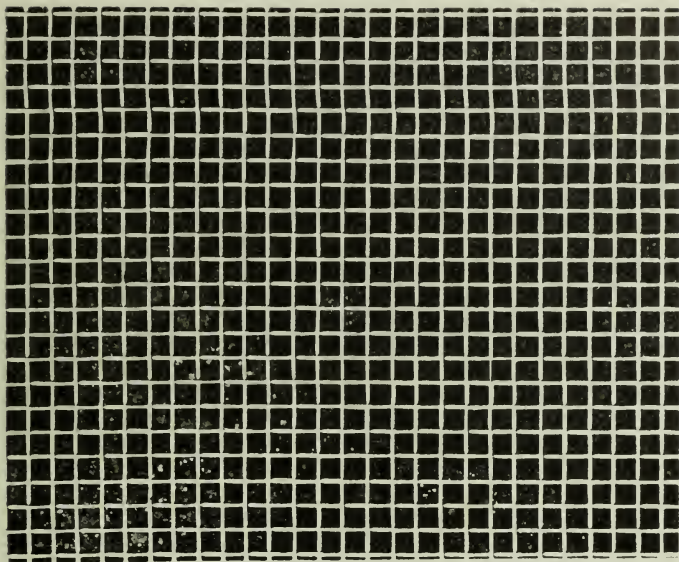


FIG. 6.—The 8 by 8 square mesh sieve. Woven wire sieves are generally used as screens in cleaning grain. Two other square mesh screens, the 7 by 7 and 9 by 9, are also used, depending on the size of the grain and nature of impurities. In preparing grain for seed use a coarser screen than when cleaning for market.

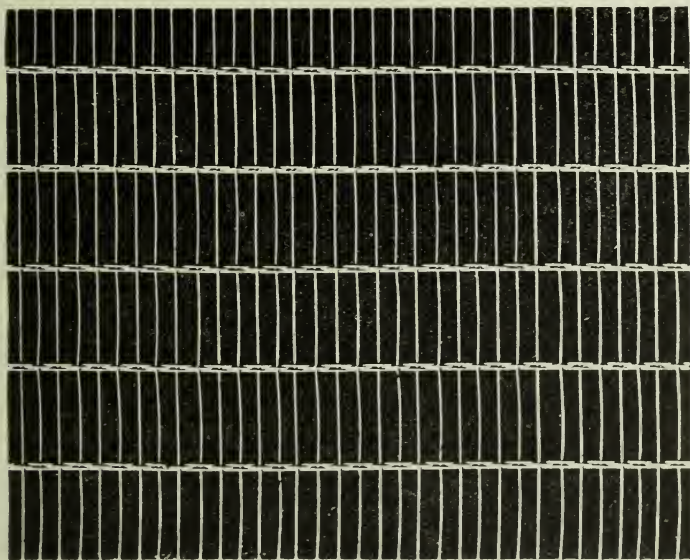


FIG. 7.—Two by ten woven sieving is commonly used in making screens for cleaning grain. The long mesh sieving is preferred to the square mesh when the grain to be cleaned contains impurities which are long and narrow, e.g. chaff in wheat. The square mesh is better for vetch and mustard. This type of screen is often used for oats.

perforations $\frac{1}{20}$ - or $\frac{1}{22}$ -inch in diameter (fig. 3) if used with only a slight slope and given a short quick shake, will accomplish this. This sieve should be used above and should take out *docks*, *Canada thistle*, *chicory*, and impurities of similar size. If the riddle is used with much slope and given a wide violent shake much of the timothy will run over with the impurities. By exercising a little ingenuity the $\frac{1}{22}$ -inch perforated zinc sieve may be used to advantage in most mills. The 22 by 22 woven wire sieve is sometimes used as a riddle in cleaning timothy seed.

Woven wire screens are recommended for the separation of weed seeds smaller than timothy; they should hold the timothy while the weed seeds pass through. They are used below and are not assisted by the air blast.

It is difficult to give explicit directions as to the proper mesh of woven wire to be used in this work. A square mesh containing 28 or 30 wires to the inch each way is often used. See fig. 4. For plump seed the 28 by 28 is preferable; the 30 by 30 is used for smaller seed. If the screen is long and if the timothy contains only very small weed seeds such as *cinquefoil* and *northern gentian*, a 32 by 32 will give good results, especially where the timothy itself is quite small. Instead of these mesh sieves the following long mesh are sometimes used: 6 by 24, 6 by 30, 6 by 34, 6 by 38, 8 by 38, or 8 by 40.

Weed seeds almost the same size as timothy and therefore difficult of separation are small-seeded false flax, ox-eye daisy, ribgrass, golden dock, stitchwort may-weed, catchfly, black medick, sheep sorrel, blue-eyed grass, lamb's quarters and wall-flower.

Samples of timothy and clover seed containing more than 10,000 weed seeds per ounce are sometimes received at the seed laboratory. In many cases proper sieves will remove most of the weed seeds and so prevent their return to the land at the rate of several thousand to every square rod.

Brome Grass

Brome frequently contains numerous impurities particularly in the first two years of the crop. Wild oats when present are difficult to remove but by careful operation of the mill many of these will scalp off the riddle. Sieves commonly used for brome are: Riddle, zinc oblong $\frac{3}{64}$ by $\frac{1}{2}$, $\frac{5\frac{1}{2}}{64}$ by $\frac{1}{2}$ or $\frac{6}{64}$ by $\frac{1}{2}$. Screen, zinc circular $\frac{3}{64}$, $\frac{3\frac{1}{2}}{64}$ or $\frac{4}{64}$.

Western Rye Grass

Many of the weed seeds found in brome grass are common also to western rye grass. Sieves recommended for western rye grass are Riddle, zinc circular $\frac{4\frac{1}{2}}{64}$ or zinc oblong $\frac{4}{64}$ by $\frac{1}{2}$ or $\frac{4}{64}$ by $\frac{1}{4}$. Screen, zinc circular $\frac{3}{64}$, $\frac{3\frac{1}{2}}{64}$ or $\frac{4}{64}$.

Crested Wheat Grass

Wire screens for this kind of seed are not recommended because they block easily. Because of the difference in size of seed between the Fairway strain and commercial seed different sieves are necessary. Sieves recommended for the Fairway strain are, Riddle, zinc oblong $\frac{3}{64}$ by $\frac{1}{4}$, $\frac{3}{64}$ by $\frac{1}{2}$, $\frac{3\frac{1}{2}}{64}$ by $\frac{1}{4}$ or $\frac{4}{64}$ by $\frac{1}{4}$. Screen, zinc circular $\frac{2\frac{1}{2}}{64}$ or $\frac{3}{64}$. Sieves suitable for the commercial seed are, Riddle, zinc oblong $\frac{4}{64}$ by $\frac{1}{2}$, $\frac{4\frac{1}{2}}{64}$ by $\frac{1}{2}$ or $\frac{5}{64}$ by $\frac{1}{4}$. Screen, zinc circular $\frac{3}{64}$, or $\frac{3\frac{1}{2}}{64}$.

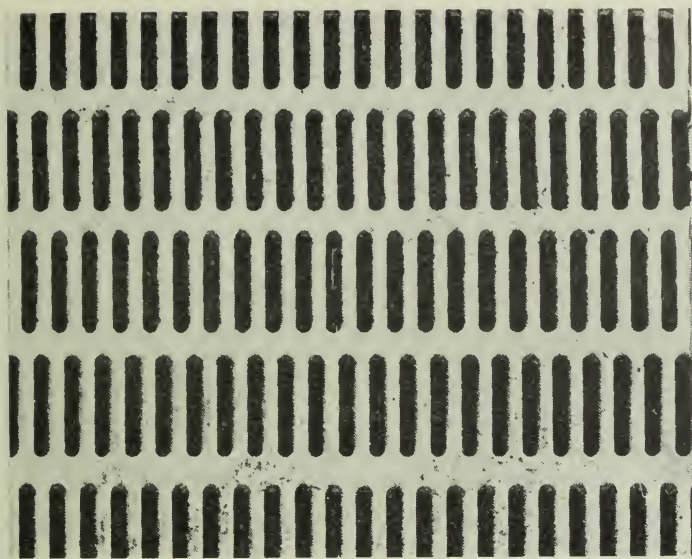


FIG. 8.—A type of perforated zinc screen sometimes used for separating the “thin” kernels of oats from the plump ones. The exact size required depends on the variety of oats grown and will vary somewhat with the season. A screen with perforations $\frac{1}{2}$ inch long and $\frac{5}{16}$ inch wide may be taken as a standard.

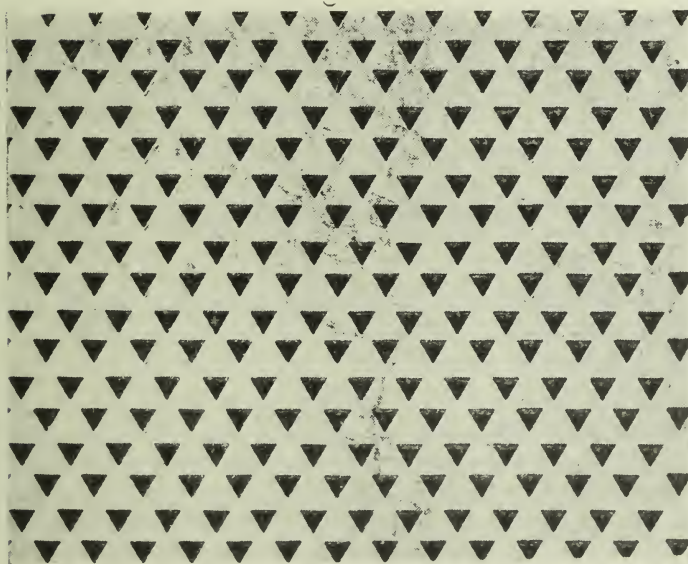


FIG. 9.—The buckwheat screen is made specially for the separation of wild buckwheat from grain. It should be used with the point of the aperture towards the upper end of the screen. If a screen of this type is given a short, quick shake from side to side many wild buckwheat seeds will fall through the triangular perforations. Screens of this kind are usually made of zinc containing perforations $\frac{3}{16}$ inch to the side, but larger perforations would probably be preferable for many samples on account of the larger size of the wild buckwheat seeds.

New Sieves for Old Mills

In most districts in the older settled parts of Canada there are a great many fanning mills that were bought twenty to thirty years ago. Many of these are still in good repair, but most of the sieves that originally came with them are lost or worn out. Of the firms who built these mills many are out of business; others are now building a mill of an altogether new model, and have not on hand a supply of frames to fit the old ones. Farmers who wish to order sieves for such a mill may use the following list as a guide in deciding what sieves to order.

The laboratories of the Seed Branch are prepared to examine samples of seed at any time with a view to advising what sieves to use and where they may be obtained. For such examination, samples of from eight to twelve ounces should be submitted. The sender should also state the kind of mill he has.

Red Clover.—Riddle, $\frac{1}{15}$ -inch perforated zinc. Screen, 4 by 24 woven wire for plump seed and for removing *ribgrass*; 4 by 26 or 4 by 28 for small seed; 20 by 20 for removing *sheep sorrel*.

Alsike.—Riddle, $\frac{1}{18}$ -inch perforated zinc. Screen, 24 by 24 woven wire.

Timothy.—Riddle, $\frac{1}{20}$ -inch perforated zinc or 22 by 22 woven wire; $\frac{1}{22}$ -inch if upper shoe of mill can be given a short quick shake; 28 by 28 below for plump seed or for removing *worm-seed mustard*; 30 by 30 for smaller seed.

Wheat.—Riddle, $1\frac{3}{4}$ -inch perforated zinc. Screen, 2 by 10 woven wire for chess, 7 by 7 or 8 by 8 for *wild vetch* or *wild buckwheat*, or *buckwheat sieve* (fig. 9) for *wild buckwheat*.

Barley.—Riddle, $1\frac{1}{4}$ -inch perforated zinc. Screen, same as for wheat.

Oats.—Riddle, $\frac{7}{8}$ by $\frac{3}{4}$ -inch zinc. Screen, $\frac{1}{12}$ by $\frac{1}{2}$ for plump seed and a $\frac{5}{64}$ by $\frac{1}{2}$ for medium or small sized varieties such as Alaska and O.A.C. No. 3.

Flax.—Riddle, 3 by 16 woven wire. Screen, $\frac{1}{12}$ -inch perforated zinc.

Central Seed Cleaning Plants

Small local seed cleaning plants, when established and skilfully operated at convenient centres, have proven to be efficient and popular, and steadily to lead to better seed supply and general improvement of crops among good farmers of the community.

A machine of the power-size clipper cleaner type is satisfactory for the complete cleaning of grasses and clovers and for performing the first operation in the cleaning of cereal grains. For the grading of cereals, this machine may be followed by one of the rotary cylinder type, and for separations, as, for instance, the separating of oats from wheat, the disc separator would be used. These three machines can be linked together efficiently by means of small elevators, and the whole plant easily operated by one man. The complete cost of the machines, including transmission and power, should not exceed \$1,200.

Seed cleaning plants of this type now in operation have cleaned from ten to fifteen thousand bushels of farmers' seed in a single season, at a charge of from five to ten cents per bushel, a rate which evidently has been satisfactory to both parties of the transaction.



Interior of seed cleaning plant showing types of machinery and arrangement.

It will be accepted that the success of any seed cleaning plant depends largely upon choosing the type or types of machines best suited for the work to be performed, and upon the intelligence and care with which these are operated.

WEEDS DESCRIBED

The following are the most prevalent or important species of weeds the seeds of which are found in commercial seed samples. The arrangement is according to botanical order.

Large Crab Grass or Finger Grass (*Digitaria sanguinalis* (L.) Scop.)—Introduced from Europe. Annual. Found as a weed in clover and timothy

fields. Culms erect or ascending from a creeping base, 1 to 3 feet long. Leaves thin, flat, 2 to 6 inches long, $\frac{1}{8}$ to $\frac{1}{4}$ inches wide, usually smooth, sometimes a little hairy. Spikes very narrow, 3 to 8, growing from one point at the end of the culm (name from digitus, a finger), greyish green, often tinged with rich purple. Spikelets $\frac{1}{16}$ to $\frac{1}{8}$ -inch long, in pairs. The seed is about $\frac{1}{8}$ -inch long, $\frac{1}{24}$ -inch wide, one side rounded, green, slightly shining, with a pointed hairy scale



nearly half its length, the other side flat, purplish, distinctly 3-ridged, hairy at the edges with a very short smooth scale at the base. Seeds occur in timothy and clover samples; found more in timothy.

Small Crab Grass (*Digitaria humifusa* Pers.) is less troublesome than the preceding species for it does not root at the joints. The seeds are smaller and brown to black in colour.

Old Witch Grass (*Panicum capillare* L.), a stout annual with hairy leaves and a large loosely spreading panicle about half the length of the whole plant, is one of our most common grass weeds. It is sometimes very abundant in grain crops and meadows when the crop stand is not strong, but it is not a serious weed on well cultivated land. After ripening the plants break off and are blown about by the wind. They are often seen in large quantities along fences. The seed is about $\frac{1}{16}$ of an inch long, spindle-shaped in outline, highly shiny, olive green, with white parallel nerves, more yellowish when unripe. It occurs often in large quantities in the seeds of timothy and other grasses and less frequently in clover seed. A number of other species of the **Panic Grasses** are quite widely distributed but none are so common as Old Witch Grass. The Panic grasses are closely related to the Foxtails but differ essentially by the absence of the persistent bristles below the florets.



Green Foxtail (*Setaria viridis* (L.) Beauv.) An introduced annual found commonly in Eastern Canada and becoming a serious pest in the Prairie Provinces where it is taking heavy toll. As an annual this weed is very troublesome because of its extreme prevalence throughout Canada. Seed colour very variable according to the degree of ripeness; yellow, grey brown or purplish, the darker seeds mottled with darker spots. The kernel is greenish white, convex on the outer face, which bears the germ, and flattened on the inner face. Green Foxtail seeds are the most prevalent impurity in clover seed. They are contained in about 90 per cent of the red clover samples analyzed at the Ottawa seed laboratory and about 50 per cent of the alsike samples. Green Foxtail seeds profusely from harvest to late autumn.



The presence of the seeds as an impurity materially reduces the value of red clover or alsike seed for commerce.

Yellow Foxtail (*Setaria glauca* (L.) Beauv.) is very similar to Green Foxtail. The branches, however, are more spreading, the whole plant is rather larger and more succulent, the spikes less compound and slenderer, with larger seeds. The bristles of the spikes are distinctly yellow. The young plant has a broad pale-green leaf and the base of the stem shows a characteristic yellow colour. The seeds are similar to those of Green Foxtail but larger. They are a common impurity in red clover, and alfalfa seed, seed grain and feeding stuffs, but are seldom found in re-cleaned alsike and timothy. On account of their relatively large size they are easily cleaned from the smaller seeds. Thick seeding with clover and grasses will help to suppress the Foxtails in the autumn stubble and subsequent clover crop. In clover seed crops the patches that have been winter-killed should be mown while the Foxtail is quite green.



Eradication.—Disc stubble immediately after harvest. Hoed crops with clean cultivation late in summer.

Sweet Grass (*Hierochloë odorata* (L.) Wahlenb.) is a native perennial, rare in the eastern provinces, growing mostly in damp places by streams and rivers but widely distributed in the Prairie Provinces where it seems to thrive on all kinds of soil. It is difficult to suppress because of its deep-rooting wide-spreading white rootstocks, which produce in summer many barren shoots with long, flat, deep green, shining leaves, over a foot in length. Flowering stems are thrown up early in spring, the first flowers opening when the stems are only a few inches out of the ground. When handled the plant produces a scent very similar to that of Sweet Clover. The naked seed closely resembles timothy, but is thinner, more cylindrical, and sometimes bears at its apex the remainder of the dried-off style (the elongated part of the pistil.) The miniature root of the germ is more prominent. The seeds are occasionally found in grass seed.



Eradication.—Shallow cultivation method. See "Perennials," page 15.

Devil Grass (*Agrostis hyemalis* (Walt.) B.S.P.). A common weed in grain land in Western Canada where it gradually starves out the cultivated grasses. It is useless as hay on account of the minute barbs on its stems which produce sores and ulcers in the mouths of the animals eating it. The plant is a very fine silky perennial growing from six inches to a foot in height and having a pinkish colour. The seeds are about half the size of Red Top and somewhat similar in appearance. Late in the season the heads break off and on account of their lightness fly long distances with a strong wind, dropping their seed in all directions.

Eradication.—Plough deeply.

Wild Oats (*Avena fatua* L.). Introduced from Europe. Annual, 2 to 6 feet high. Plants closely resemble cultivated oats. Head spreading, usually

nodding; seed-bearing stems very slender, bending with the weight of the seeds, giving the head a drooping appearance. The seeds vary somewhat in size and greatly in colour, from almost black to brown, grey and white. All forms are similar in shape to cultivated oats, but are slimmer and at once distinguished by the stiff twisted awn, the hairs which are particularly prominent at the base, the slanting horseshoe-shaped scar, and the minute stalk (rachilla) supporting the second or "bosom" grain. In Wild Oats this is stout, becoming wider and



terminating at the top in a slanting surface, while in cultivated oats it is thread-like throughout its entire length. In threshed grain many of these distinguishing marks may be broken off but usually some remain.

False Wild Oats, often confused with the above, are a form of cultivated oats. The plants appear to be identical with those of the cultivated variety in which they occur but the seeds resemble those of Wild Oats in having both the long stiff awn and horseshoe-shaped base. They are, however, generally less hairy and stouter and do not differ in size from those of the cultivated variety in which they originate. False Wild Oats germinate readily the fall they ripen while the germination of true Wild Oats is deferred. This is very important and is the reason why wild oats are much more dangerous as a weed than false wild oats. In the case of the former summer-fallowing and cultivation have not always the effect of causing seeds in the soil to germinate, so that land may remain infested for a long time.

Eradication.—It is impossible to clean land of Wild Oats in one or even two seasons. Their control necessitates timely and careful tillage and the use of suitable crops over a period of years. See "Annuals," page 11.

Chess (*Bromus secalinus* L.), in a winter annual widely distributed wherever winter wheat or other fall or winter crops are grown. The stems are erect and



simple. The portion of the leaf that embraces the stem is smooth, strongly nerved. Panicle loose, its branches somewhat drooping, with many flowered, hairless spikelets, which are so distinct as to show openings between them along the stalk, when viewed from the side. The seed is about $\frac{1}{3}$ -inch long, inclosed in scales of the same length. The outer scale is convex, thick and unrolled at the margin when ripe, provided with a short bristly awn. The inner scale is bordered with stiff hairs and adherent to the kernel. The footstalk of the grain above is strongly curved and club-shaped. The seeds are a com-



mon impurity in winter wheat, and, to a less extent, in winter rye and other grains and seeds of commerce, and in feeding stuffs. Chess is objectionable in wheat for milling as it gives the flour a dark colour and a disagreeable flavour. Removing it by cleaning causes considerable loss of the smaller grains of wheat.

Eradication.—Avoid winter wheat. Short rotation of crops. Hoed crops.

Common Darnel (*Lolium temulentum* L.)—Introduced from Europe. Annual, smooth, stems 2 to 4 feet high, simple. Leaves smooth beneath, rough above, the portion embracing the stem is purple when the plant is young. Spike 6 to 10 inches long; somewhat resembling that of Couch Grass, but having the edges of the spikelets resting against the stalk instead of the broadsides, as in Couch Grass. The seed, somewhat swollen, resembles small barley, with blunt ends and a shallow wide groove on the inner surface.



The inner scale is minutely bristly on the edges but not coarsely bristly along the margins, as in Chess; the outer scale is hard and flinty, as in the chaff of wheat, and either with or without a long awn. The kernel, after the husks have been removed, is greenish-brown, often tinged



with deep purple. The scales cover the seed very tightly, the inner one being adherent to it; in that condition it is nearly the same size and weight as small grains of wheat and is exceedingly difficult to separate from it by machinery. Darnel caused considerable alarm in Southern Manitoba about 1905. Since then its occurrence has only occasionally been reported.

Eradication.—Similar to Wild Oats. Seed affected areas to grass.

Couch or Quack Grass (*Agropyron repens* (L.) Beauv.) is widely distributed throughout Canada and a most injurious weed in all kinds of soil. It is perennial by wide-spreading but shallow fleshy rootstocks, forming large matted beds. Flowering stems rather freely produced, smooth above, downy below. Flowers in 3- to 7-flowered spikelets, forming a narrow spike with the spikelets lying flat against the stalk. Leaves dark green, rather distinctly ribbed, and more or less hairy below.



The seeds are seldom found in cereals, timothy or clover seed but occasionally in the coarser grasses, and in litter from hay or straw containing mature Couch Grass



Eradication.—To destroy this persistent weed let it exhaust its substance in the production of a hay crop,

which should be cut and removed as soon as the head is formed and before it is in blossom. Plough shallow and cultivate. Rootstocks brought to the surface should be gathered and removed or burned. This may be followed by a cleaning crop of rape, buckwheat or millet and a hoed crop the next spring.

In the Prairie Provinces particularly, "shallow cultivation method" is recommended. See "Perennials," page 15.

Skunk-tail Grass or **Wild Barley** (*Hordeum jubatum* L.) is a native perennial occurring from Lake Superior westward, particularly in alkaline soil where better grasses can not thrive, and occasionally in Eastern Canada. This grass is a serious enemy to western stockmen, being a source of much injury to horses, cattle and sheep. The barbed seeds and awns penetrate the soft tissues of the mouth, causing irritation and inflamed ulcers, and work down beside the teeth, producing inflammation and swelling. It does not flower the first year, forming tufts 8 to 12 inches high. Leaves greyish-green. Flowers in beautiful, silky, bristly heads, 3 to 4 inches long, pale, yellowish-green often tinged with red. The seed produced by the female flower is slender, sharp pointed, somewhat resembling a miniature seed of barley, and provided with a long, upwardly barbed awn. The heads adhere to passing animals and are carried long distances by the wind.



Eradication.—There is no difficulty in eradicating this grass from land that can be ploughed, but it gives considerable trouble in waste places where it ripens its seed which is widely scattered by wind and water.

Sedges (*Cyperaceae*).—The sedges are similar to grasses in general appearance, with fibrous roots and mostly solid stems. Some species are troublesome weeds on wet lands. **Yellow Nut-grass** (*Cyperus esculentus* L.) is a troublesome weed in hoed crops or timothy grown on wet land. It spreads underground by small nut-like tubers and is difficult to eradicate. The stems are triangular, stout, 1 to 3 feet high, leafy at the base, with two or three leaves at the summit. Leaves light green, $\frac{1}{8}$ - to $\frac{1}{4}$ -inch wide, about the same height as the stem. These deep yellow or light chestnut coloured heads are easily seen in a field of timothy. The seeds, about $\frac{1}{32}$ -inch in length, 3-angled, light brown, are occasionally found in samples of timothy, but very seldom if ever in clover seed. Sedges are chiefly wet land plants and their presence is usually a sign that the land needs draining. Thorough underdrainage will tend to eradicate sedges by making conditions less suited to their growth as well as by making the crop more vigorous and choking them out.



Fox Sedge (*Carex vulpinoides* Michx.) is another species troublesome on low lands. This seed is sometimes found in timothy in great abundance, being more prevalent than the former species.

Ovoid Spike-rush (*Eleocharis ovata* (Roth) R. & S.), is a species of sedge widely distributed in wet places, the seeds of which are often found in timothy and occasionally in red clover samples. The seed is top-shaped, pale to rich chestnut brown, smooth and shining, about $\frac{1}{16}$ -inch long and $\frac{1}{32}$ -inch wide, with a lighter coloured triangular tubercle at the apex, $\frac{1}{4}$ its length, and 6 to 8 pale barbed bristles attached to the base of the seed and extending slightly beyond the tubercle. Usually found in timothy samples with one or more of the bristles



broken off. Owing to their small size these seeds can readily be cleaned from most kinds of commercial seeds. Lands infested with this, or other species of sedges, should be thoroughly drained if possible and given clean autumn cultivation followed by hoed crop.

Docks (*Rumex* species).—The most common member of this group is **Curled Dock** (*Rumex crispus* L.) shown in the illustration. It is a perennial with a deep tap-root. Stem 2 to 3 feet, smooth, erect, terminating in wandlike racemes. Root-leaves, oblong-lance-shaped in outline with much crested or waved margins, 6 to 12 inches long, on long stalks; stem-leaves on short stalks and much smaller or absent towards the top of the stems. Curled Dock is a common weed in meadows, pastures and waste places throughout Canada, being very abundant in Southern and Western Ontario. The seeds of the Docks are commonly found in clover seed.

They are very similar in appearance, but have the following points of differentiation: Curled Dock seeds, illustrated, $\frac{1}{12}$ of an inch long, shaped like a miniature beech-nut, nearly symmetrical, both ends pointed, widest near the centre, the edges very slightly margined, reddish brown and highly shiny; **Clustered Dock** (*Rumex conglomeratus* Murr.), apex of the seed pointed, base rounded, smaller, plumper, dark reddish brown; **Bitter Dock** (*Rumex obtusifolius* L.), seed unsymmetrical, widest below the centre, edges unmarginated, the base with a rough scar, brownish, yellow, dull.

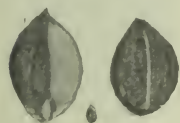
Eradication.—Short rotation of crops. Hand pulling.

Sheep Sorrel (*Rumex Acetosella* L.) is naturalized from Europe and is now common in all parts of the country. It is a perennial and very persistent by extensively spreading, yellow, fleshy rootstalks. Stems slender, 6 to 18 inches, erect or nearly so, branched above. Leaves with silvery ear-like appendages, spreading outward from the base, narrowly arrow-head-shaped, toothless, 1 to 4 inches long, quite smooth and rather fleshy, on long stalks. Flowers numerous in panicle-like racemes, of two kinds on separate plants; the male flowers have conspicuous stamens; the female are much less showy and are tipped with three tiny, crimson, feather-like organs (the stigmas). The seeds, as they occur among clover

and grass seeds, are generally covered by the three larger conspicuously veined calyx divisions which fit closely over the seed. The naked seed, when the calyx divisions

are removed, is $\frac{1}{20}$ of an inch long and nearly as broad, triangular-ovate, pale brown, shining. The seeds are one of the most abundant impurities in clover and grass seeds, being especially common in alsike.

Eradication.—Application of lime. Good cultivation with hoed crops. Pasture with sheep.



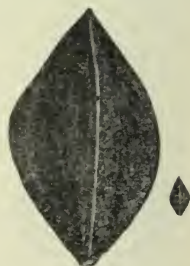
Lady's Thumb (*Polygonum Persicaria* L.) is an annual common all over the country, especially in low fields and meadows. Although Lady's Thumb and other of the Knotweeds and Smartweeds are widely distributed, they are not seriously noxious in most field and garden crops. The stems are erect, fleshy, nearly smooth, hairless. Leaves lance-shaped, pointed, nearly stalkless, the surface roughish, often dotted and marked with a dark triangular or round spot near the centre. The mode of flowering is an ovoid or short cylindrical spike, dense, erect, composed of pink or dark purple flowers. The seeds are



about $\frac{1}{12}$ of an inch in diameter, ovate, heart-shaped, hollowed out on one side or roundly triangular, jet black, shining. They are a common impurity in red clover and are less frequently found in alsike, alfalfa and grass seed. **Pale or Dock-leaved Persicary** (*Polygonum lapathifolium* L.) very closely resembles Lady's Thumb. It is a common, tall-growing and rather aggressive weed among grain and clover on rich low land in all parts of eastern Canada. The seed is $\frac{1}{10}$ of an inch long, more roundly heart-shaped, chocolate brown, hollowed on both sides and never triangular.

Eradication.—Drainage. Late cultivation with hoed crops.

Wild Buckwheat (*Polygonum Convolvulus* L.) is general in cereal crops throughout Canada, but most prevalent in the Prairie Provinces. It is an annual introduced from Europe; a twining vine with rather rough branching stems and thin smooth, arrow-shaped leaves. Flowers greenish, drooping on short slender stalks, in small clusters, arising from the axils of the leaves, and in loosely flowered terminal racemes. Calyx 5-parted, persistent. The seed is dull, black, triangular, about $\frac{1}{8}$ -inch long, bluntly pointed at the apex and almost twice as long as broad, widest just above the middle; the germ is club-shaped, small, curved and lies along one angle of the seed in a groove. When found in commercial grain, the seeds are often without the black coat and appear naked, white, wax-like, with slightly rounded angles. They



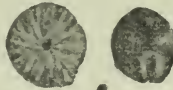
are the most common impurity in cereals, being especially abundant in western grain, and constitute a very large percentage of the weed seeds occurring in elevator screenings. They are considered good feed, specially for poultry.

Eradication.—Summer fallow. Most of the early plants can be destroyed in grain crops by harrowing when the grain is about three inches high.

Lamb's Quarters (*Chenopodium Album* L.) occurs throughout Canada in rich land. It is one of our most common garden weeds and commonly



appears in cultivated fields. An annual, introduced from Europe and native. Extremely variable in every character. Mostly tall, succulent and herbaceous, with a slender, erect, grooved, much-branched stem, 2 to 6 feet high, with angular-ovate, pale green, coarsely toothed leaves, narrowed at the base and borne on slender footstalks. Flowers in compound spikes from the axils of the leaves. The seed is about $\frac{1}{20}$ of an inch in diameter, circular in outline, more or less flattened on one side, strongly convex on the other, edges bluntly rounded, the



lower convex face grooved from the margin to the central scar, minutely wrinkled; colour shining black. The seeds, as found among crop seeds, have a thin envelope

closely adhering to them, as a brown or gray mealy deposit, which gives them a granular-roughened appearance; they also often have the dried, 5-angled calyx closed tightly over them. They are a common impurity in alfalfa and timothy, especially in the west. The seed is so nearly the same size as that of timothy that its separation is difficult so that this weed should be hand-pulled from fields intended for seed. Next to wild buckwheat, these seeds are the most prevalent impurity in grain. Its hard flinty seed-coat makes it difficult to grind, so that it commonly occurs unground in feeding stuffs made from poorly cleaned grain.

Eradication.—As for Wild Buckwheat.

Russian Pigweed (*Axyris amaranthoides* L.) was first noticed in Canada in 1886, by the roadside at Headingly, Man., 14 miles west of Winnipeg, where

it is said to have been brought direct from Russia. It is now found along the railways throughout the West, and has been even detected on a railway bank as far east as Saint John, N.B. It is an annual, tall, coarse plant, from 2 to 4 feet high, erect and widely branching, very leafy. When young much like Lamb's Quarters, but paler green with a more wand-like habit of growth, and instead of being mealy in appearance it has soft, short, star-shaped hairs. When full grown the whole plant forms a large pyramidal compound raceme; the stems, bracts and



the papery calyx segments turn white and make it very conspicuous. The seed is oval, flattened, $\frac{1}{12}$ of an inch long, gray or brown with a silky lustre surface minutely lined



and wrinkled lengthwise, basal scar a short thin groove across the lower end; many seeds have a close-fitting papery envelope, projecting above the top as a 2-lobed wing. The seeds are occasionally found in commercial samples.

Eradication.—Fields badly infested should be thoroughly summer-fallowed and the succeeding grain crop treated with the harrow when the plants are a few inches high.

Red-root Pigweed (*Amaranthus retroflexus* L.) is an annual introduced from tropical America and now established in all settled parts of the Dominion. It has a rosy pink tap-root. Stems erect, simple or branched, rough-hairy. Leaves on long stalks, ovate, bristle-pointed. Flowers inconspicuous, numerous, crowded into thick compound spikes at the ends of the branches and in the axils of the leaves. The seed is highly polished, reddish black to jet black, about the same size as that of Lamb's Quarters, circular or egg-shaped in outline, much flattened and equally convex on both sides. An immature or shrunken seed has a narrow, slightly flattened marginal band, which marks the location of the ring-like germ. Pigweed seeds are quite commonly found in clover and grass seeds especially alsike and timothy. Red-root Pigweed is especially troublesome in garden and in potato and field root crops.



Eradication.—When embedded in the soil, the seeds retain their vitality for several years and produce seedling plants only when brought within about two inches of the surface by cultivation. Late cultivation of hoed crops should be made as shallow as practicable.

Tumble Weed (*Amaranthus graecizans* L.). A large bushy annual forming under favourable conditions a compact mass from one to two feet in diameter.

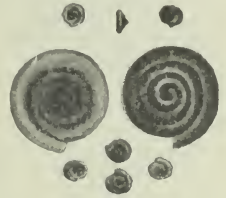


Leaves small oval, narrower at base. Flowers very small, borne in clusters in the axils of the leaves. When ripe the plants break off at their base and taking advantage of each wind, travel long distances, scattering their seeds as they go. Seeds black, very shiny, closely resemble Red-root but smaller and rounder in outline. They are often in western timothy and among the seeds of other fodder plants. This weed occurs chiefly on newly broken land in the Prairie Provinces where it is often abundant and a factor of no small importance in robbing the soil of moisture. It is, however, seldom injurious on old well-tilled soil.

Eradication.—Early disking or breaking. Summer-fallow followed by late spring harrowing of grain crop.

Spreading Amaranth (*Amaranthus blitoides* Wats.). Resembles common Tumble Weed but has rather large leaves and a prostrate manner of growth, forming mats upon the ground. The seeds which occur in alfalfa may be told from other Amaranths by their larger sizes.

Russian Thistle (*Salsola Kali* L., var. *tenuifolia* G.F.W. Mey.) is an annual introduced from Asia. It is abundant in several localities in the dryer parts of Alberta and Saskatchewan, chiefly along roadsides, fire-guards and in neglected fields and is frequently found, though not seriously troublesome, in the eastern provinces. Russian Thistle is a large succulent weed and thrives where the land is too dry for other plants. It is bushy, of a prickly appearance, due to the thin, thread-like, prickle-tipped leaves which characterize the young plant, and the short, triple, spiny bracts on the flowering branches of the older plants. It varies in appearance at different stages of growth. The young plant is dark green, the slender leaves, about two inches long, drop off soon after the seed is

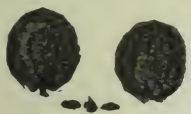


formed. The somewhat spherical branched top of the mature plant, when broken away from the root, is blown about by the wind and scatters its seeds widely. It is not a thistle and could be more appropriately called a tumble weed. Flowers solitary, borne in the axils of the leaves. The seed is about $\frac{1}{16}$ of an inch in diameter, cone-shaped, the large end concave with a well-marked protuberance in the centre of the cavity. The coat is thin and transparent, showing the greyish-brown, coiled germ. The seeds are generally enclosed in a papery envelope, the divisions of which are winglike. They occur quite frequently in imported alfalfa seed.

Eradication.—Careful summer fallowing every second year will prevent its giving serious trouble.

Spurrey or Corn Spurrey (*Spergula arvensis* L.) is an annual, now found quite commonly in grain fields in the eastern provinces and in parts of British Columbia. Stems branching from the base, 6 to 18 inches high, almost smooth, sparingly hairy above. Leaves narrowly linear, apparently in a circle around the joints of the stem but really in two opposite sets of 6 to 8 together, with scale-like modified leaves between them. Flowers white, the fruit hanging abruptly downward. The seed is dull black, lens-shaped or round and compressed, with the margin extended into a narrow pale wing. The surface is more or less roughened with small, pale-coloured, elongated protuberances, like gland-tipped hairs.

Both the protuberances and the wing are sometimes absent when the seeds occur among commercial seeds. They are a common impurity in grain grown in the Maritime Provinces and Quebec and in timothy from Prince Edward Island.



Eradication.—Use clean seed. Cultivate hoed crops thoroughly. Disking grain fields immediately after the harvest is removed will promote the germina-

tion of a large percentage of the seeds and the resulting seedlings will later be killed by frost.

Grass-leaved or Lesser Stitchwort (*Stellaria graminea* L.) perennial, the underground rootstocks sending up flowering stalks at intervals of a few inches; two inches to two feet high, slender, weak, four-angled and roughened on the angles, with many grassy leaves in pairs; bearing many starry white flowers nearly $\frac{1}{2}$ -inch across. The seed is often found in clover and grass seed; it is the same size as that of Common Chickweed but more nearly circular. The surface markings are quite different; instead of bearing tubercles, thickly covered with short curved ridges in more or less regular rows.

Eradication.—Close and frequent cutting, as recommended for other perennials.

Common Chickweed (*Stellaria media* (L.) Cyrill) in spite of its frail appearance is a very hardy and persistent weed. It is an introduced annual occurring in all parts of Canada where the soil is moist and rich; stems diffusely branching, curving upward with a tendency to lie down. Root hair-like and exceedingly tough. Leaves ovate. Stems bearing a conspicuous stripe of hairs down one side. Flowers $\frac{1}{4}$ -inch in diameter, numerous, solitary from the axils of the leaves, in old plants in terminal leafy cymes; corolla white. Fruit capsules cone-shaped, spreading or hanging down, longer than the calyx. The seed is small, $\frac{1}{24}$ of an inch in diameter, yellowish brown to dark brown, wedge-kidney-shaped, flattened and covered with coarse tubercles arranged in regular curved rows, about 5 on each side and 4 on the edge.



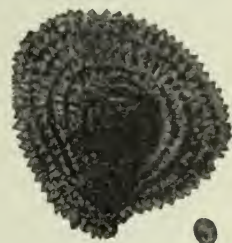
It is frequently found in clover and timothy seed and many samples, especially of timo-

thy, are rejected on account of the prevalence of this impurity. It is so small that it may be removed without wasting any of the timothy. The 30 x 30 woven wire screen will accomplish this separation.

Eradication.—Clean cultivation of hoed crops; disking of bare stubble lands directly after harvest, to check further seeding.

Mouse-Ear Chickweed (*Cerastium*) seeds are frequently found in clover and timothy samples. The seeds are small and may be removed by the sieves recommended for Common Chickweed seeds. The plants are somewhat similar to Common Chickweed. They have much the same habit of growth but are covered all over with downy hairs, whereas in Common Chickweed the hairs are confined to a line down one side of the stem.

Purple Cockle (*Agrostemma Githago* L.).—Introduced from Europe. Annual and winter annual. Erect, 1 to 3 feet high; branches few; whole plant covered with soft, silky hairs; not viscous. Leaves 2 to 5 inches long, narrow and pointed. Flowers purple, borne at the tips of the stems and branches, $1\frac{1}{2}$ inches across. Fruit capsule ovoid, with 5 teeth at the apex. It occurs in grain fields throughout Canada. The seed is pitchy black, from $\frac{1}{12}$ to $\frac{1}{8}$ of an inch in diameter, somewhat flattened, rounded triangular; the thin edge notched by the scar of attachment; rough, covered with rows of short teeth. It is difficult to separate the seeds from wheat without a heavy loss of grain. When ground with wheat, the seeds give the flour a dark colour and a bad flavour. They are a very common impurity in seed wheat and are found less frequently in seed oats.



Eradication.—Summer fallow. Hand pulling.

Night-Flowering Catchfly. (*Silene noctiflora* L.)

The name of this plant is quite apt. The stems are covered with a sticky substance by which small insects are often entangled on the stems and leaves. Its few, large, creamy white flowers open at night or during a cloudy day and close when the sun shines. The stem is from one to three feet tall, rather stout, branching.

Catchfly is a very common weed in meadow and grain fields and in hoed crops. It is a rank grower and heavy seeder and is particularly troublesome in clover fields. Its seeds are impossible of separation from alsike except by the use of special machinery, and consequently seed harvested from fields containing much catchfly must be sold at a very low price. From timothy and red clover its seeds are separated with only a little less difficulty than in the case of alsike. On account of the plant's pungent flavour and woody texture it is objectionable to live stock, whether in pasture or cured fodder, and when at all prevalent in hay a considerable waste results.

The seed is about $\frac{1}{20}$ of an inch in diameter, very slightly flattened, dull greyish-brown, with 8 to 10 curved rows of tubercles on each side.



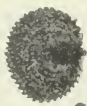
Eradication.—As the plant is propagated entirely by seeds its suppression is accomplished by preventing it from seeding and by inducing the seeds already in the soil to germinate and then killing the seedlings. Catchfly will not long give trouble on land worked under a short rotation of crops. Its appearance in alsike fields is largely due to its being sown with the clover seeds.

Bladder Campion (*Silene latifolia*, (Mill) Britten and Rendle) and **White Cockle** (*Lychnis alba*, Mill) are near relatives of catchfly.

The seeds of these two plants are not nearly so common in clover and timothy seed, but the plants are much more difficult to eradicate from fields in which they become established. Bladder campion is perennial, with deep-running root stocks and is the most dangerous weed of this group. It has become widely distributed in the eastern provinces during recent years, and has proven to be very difficult to suppress. The whole plant is pale green and in the common form perfectly smooth; stems one foot to eighteen inches high, forming large tufts; leaves in pairs, meeting round the stems; flowers white, nearly an inch across, drooping; calyx much inflated, pale green, veined with bright purple, toothed at the contracted apex.

White cockle is a biennial or short-lived perennial, sparingly distributed in Ontario as yet. The rootstocks are thick, sending up a few short barren shoots and long branching flowering stems, 1 to 2½ feet high. The whole plant is viscous, hairy, but not so much as catchfly. It is wider branching, has many stems, the leaves are larger, the flowers more numerous and pure white.

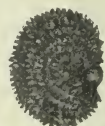
Eradication.—Use only clean seed. If the infested ground is in meadow it should be broken up and the subsequent cultivation made to include a "black summer-fallow." See "Perennials," page 15.



White Cockle



Catchfly



Bladder campion

The seeds of the three plants are very similar in appearance. With catchfly the tubercles with which the surface of the seed is covered are not symmetrically arranged, while with bladder campion and white cockle they are in concentric rows. With white cockle the rows are slightly farther apart than with bladder campion.

Forked Catchfly (*Silene dichotoma* Ehrh.)—Annual not common in Canada. The plant is from 1 to 2 feet high and is hairy. The flowers are white without petioles as a rule; when these are present they are very short and are arranged in forked one-sided spikes. The seeds, which are found in imported clover seed, are difficult to distinguish from those of bladder campion.

Tarry Cockle or Sleepy Catchfly (*Silene antirrhina* L.). A somewhat slender annual with small pinkish white flowers and greenish stem bearing at intervals on the upper branches long purplish sticky patches. The seeds are similar to Catchfly but about half the size and rather darker.

Eradication.—Disking of stubble land after harvest to prevent seeding, short rotation of crops and clean cultivation of hoed crops.

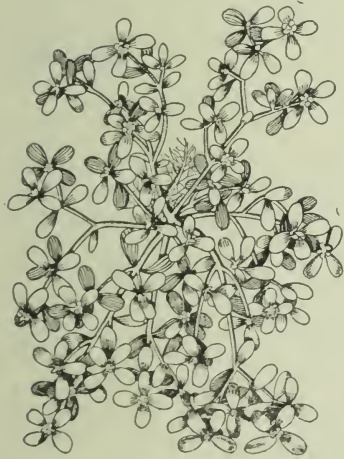
Cow Cockle (*Saponaria Vaccaria* L.).—Introduced from southern Europe. Annual. Stem simple, branching above or much branched from the base, 1 to 2½ feet. The whole plant is smooth, succulent and of a greyish-green appearance, like the leaves of a cabbage. Leaves ovate-lance-shaped, clasping the stem. Flowers pale rose-pink, ½ inch across, in loose corymb-like cymes. Calyx ovate, 5-ribbed and much inflated, winged and angled in fruit. The smooth roundish fruit capsules contain about 20 seeds each. A troublesome weed only in the Prairie Provinces. The seed is round, hard, dull black, about ⅛-inch in diameter, and is often confounded with the seeds of wild vetches. It can be distinguished from vetch seeds of a similar size by its minutely roughened surface, or by cutting it open after soaking, when the germ, which lies in a circle around the seed just beneath the seed-coat, will be seen. It in no way resembles the inside of a vetch or pea, which when the seed-coat is removed after soaking, can



be easily separated into similar halves. The seeds are a common impurity in commercial wheat and are almost as objectionable to the miller and baker as are those of Purple Cockle.

Eradication.—Summer fallow. Hand pull to prevent seeding.

Purslane (*Portulaca oleracea* L.) is an annual introduced from Europe, now common in rich land, particularly in gardens; most abundant in the eastern provinces. It is a fleshy prostrate, perfectly smooth plant, freely branching from a single central root, with fleshy reddish stems and dark green, alternate, obovate or wedge-shaped leaves mainly clustered at the ends of the branches. Flowers stalkless, solitary, about ¼ of an inch across, yellow, opening only on sunny mornings. Fruit capsule, membranous, many seeded, the top coming off as the lid of a box. The seed is black, roughened but shiny, about ¼₀ of an inch in diameter, narrowly kidney-shaped, much as in the Pink family, and like the seeds of most of the members of that family, with a curved germ running around the outside of the seed.



Eradication.—The seeds retain their vitality for several years. They do not germinate until the soil has

become quite warm and they have been brought near the surface by cultivation. Several years of careful cultivation are required to eradicate Purslane. Seeds that have formed will develop and mature on the fleshy stems of the plant after it has been cut which makes it necessary to remove and destroy the plants after cutting. The seeds are seldom found in commercial samples.



Tall Buttercup (*Ranunculus acris* L.) occurs throughout Canada, especially in moist lands. It is a noxious weed with a poisonous, acrid, blistering juice; common in pastures and meadows. Perennial, with fibrous roots. Stems erect, generally hairy. The leaves in 3 divisions, each division stalkless, 3-cleft or parted, with deeply lobed segments. Flowers yellow. The dry seed-like fruits are in heads. The seed is about $\frac{1}{8}$ of an inch in diameter, flat, nearly round in outline but unsymmetrical with a somewhat wing-like margin; both the tip and the scar ends are pointed and very prominent, the former generally hooked. The colour varies from greenish-brown to nearly black; dull from the roughened surface. The seeds are occasionally found in commercial samples. Several allied species are prevalent in many districts as weeds of secondary importance. **Cursed Buttercup** or **Ditch Crowfoot** (*Ranunculus sceleratus* L.) is abundant along ditches, creeks and ponds and is occasionally found in wet pastures. **Small-flowered Buttercup** (*Ranunculus abortivus* L.) is common in old pastures and woods, less frequent in meadows and cultivated fields.



Eradication.—Drainage. Thorough cultivation with short rotation of crops. Avoid seeding to grass until suppressed.

Wood Whitlow Grass (*Draba nemorosa* L.) is a native annual and winter annual. Stem low, branching below. Leaves stalkless, oblong-ovate or lance-shaped, somewhat toothed roughish. Flowers small, yellowish. Pods elliptical-oblong, half the length of the foot-stalks which are almost horizontal at maturity. The seeds are very small oval or egg-shaped and orange in colour. The flowers appear in May or late April and most of the injury is done during the former month. Troublesome only on summer-fallow or in gardens; easily destroyed by spring cultivation.



Stinkweed (*Thlaspi arvense* L.). Introduced from Europe. Annual and winter annual. Whole plant bright green and quite smooth. Root leaves borne on foot stalks; stem leaves clasping the stem with the arrow-shaped base. Flowers clear white, $\frac{1}{8}$ of an inch across. Pods flat, $\frac{3}{4}$ -inch across, pale green and winged, notched at the top. Just before the seeds ripen the pods turn a characteristic greenish-orange shade, easily noticed when this weed is growing among crops. Stinkweed is now found in every province in Canada, but nowhere is it such a terrible pest as in the Prairie Provinces where it was introduced with the first settlers. The seed is about $\frac{1}{12}$ of an inch across, a little longer than broad, deep purplish-brown, unsymmetrically oval in outline, flattened, with rounded edges. The flattened surface has 5 or 6 loop-like lines, which start at the basal scar or notch and run concentrically around a central groove. The seeds are frequently found in western grain and grass seeds.



Eradication.—Summer fallow. Disk as soon as the grain crop is removed. Late fall and early spring cultivation. Harrow once or twice when grain is two or three inches high.

Peppergrass (*Lepidium apetalum* Willd.) is a native annual and winter annual, widely distributed but most abundant in light sandy soil. Stems erect, profusely branching above, 6 inches to 2 feet high, somewhat hoary with short appressed hairs. Autumn plants produce a rosette of dark-green, deeply indented leaves, much like some specimens of Shepherd's Purse but more succulent. Stem-leaves with a few coarse teeth, narrowed at the base. The many nearly erect and spreading branches give this plant, when in seed, the appearance of a miniature tree, the numerous small, nearly round, flat pods taking the place of leaves; the real leaves fall away when the seeds begin to ripen. The flowers are minute.



The seed pods are about $\frac{1}{10}$ of an inch wide, heart-shaped, slightly longer than wide, notched at the top and at maturity separate into halves. The seed is about $\frac{1}{16}$ of an inch in length, bright reddish-yellow, egg-shaped in outline, much flattened, blunt on the straight side and very thin or slightly winged on the rounded side; both sides show a rather deep groove in the middle. When moistened the seeds develop a large amount of mucilage. Although there are only two seeds in a pod, each plant produces thousands of seeds. They are a common impurity in clover and grass seed, being especially abundant in timothy.

Eradication.—Thorough spring cultivation. Badly infested fields should be disked or ploughed directly after harvest, cultivated from time to time until winter and again until late June when they may be planted or sown to a late fodder crop.

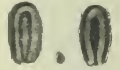
Hoary Cress (*Lepidium draba* L.) a perennial imported from Europe. Plant eight to twenty inches high; leaves long, ovate, irregularly toothed to almost entire. The flowers small and white with seeds borne in heart-shaped, two valved pods. Seeds are dark reddish-brown, flattened and about size of alfalfa seed. Root system consists of large well developed root stocks which penetrate to a depth of several feet and spread horizontally in all directions.

Eradication.—Small areas may be controlled by repeated hoeing. Large areas should be ploughed to a depth of three inches and packed about the middle of July. Cultivation should continue throughout the season to prevent any leaves forming above the surface.

Field Peppergrass or Cow Cress (*Lepidium campestris* (L.) R. Br.) is a biennial yet rare in Canada but occurring in the clover-growing districts of Ontario where it is increasing. The plant grows with two or three stems from the same root. The lower leaves are oblong and toothless; those of the stem are spear-shaped with blunt ends. The thick pods are broadly ovate, boat-shaped, being rounded below and hollowed out above. Each pod contains two seeds. The seed is $\frac{1}{12}$ of an inch long, egg-shaped, but pointed at the scar end. The surface is finely roughened and dull, with a mealy appearance. Two grooves, often filled with mucilage, extend from the sharp basal end almost to the other end of the seed. These seeds are now much more common than those of Peppergrass in red clover and alfalfa and are found to a less extent in alsike seed.



Shepherd's Purse (*Capsella Bursa-pastoris* L.) is an annual and winter annual occurring throughout Canada. The plants vary greatly. A seed-bearing plant may be a dwarf, little more than an inch or two high, or a vigorous, branching plant, three feet high, with many pods. There may be at the base a vigorous rosette of leaves, or none at all. The leaves may be deeply cut, pinnatifid, or without any teeth or division. The stem leaves are for the most part arrow-shaped, with two sharp, ear-like projections, one on each side of the stem. The flowers are small and white. The seed-pod is flat, triangular in shape $\frac{1}{4}$ of an inch long, wedge-shaped at the base, notched at the top, with the outer angles rounded. Each pod contains about 20 seeds. The seed is small, $\frac{1}{24}$ of an inch long, oblong, reddish-brown, the surface dull and punctured. When put in water it develops a large amount of mucilage and a covering of long but very fine transparent hairs. The seeds occur quite frequently in alsike and grass seed and occasionally in red clover. Shepherd's Purse has an enormous power of propagation; a single plant will ripen 50,000 seeds. In meadows which have been thinned by winter killing the vigorous rosettes of autumn-started plants will crowd out grass and clover.



The seed is a common impurity of alsike and timothy seed but is so small that it may be easily removed by a fine woven wire sieve.

Eradication.—Summer-fallow. Spring cultivation. Hoed crops.

Western False Flax (*Camelina sativa* (L.) Crantz).—Introduced from Europe. Annual and winter annual, 2 to 3 feet high, erect, slender, branching near the top. Root-leaves lance-shaped and narrowed into a foot stalk; upper leaves arrow-shaped, sharply pointed. The lower leaves and the lower part of the stem downy with star-shaped hairs. The upper part of the stem smooth and covered with a fine bloom. Flowers numerous, small, $\frac{1}{8}$ -inch across, pale greenish-yellow. Pods $\frac{3}{8}$ -inch long, balloon or pear-shaped, margined and tipped with a slender beak, on slender foot-stalks, curving upward, each containing about 10 seeds. Seeds yellowish-brown, about $\frac{1}{12}$ -inch long. The miniature root of the germ very prominent, lying along the seed. Seed-coat finely pitted. The seed is a very common impurity in flax, especially from Western Canada. It also occurs in Ontario, particularly in fall wheat.



False Flax



Flat-seeded False Flax (*Camelina dentata* Pers.) was introduced into Manitoba in 1906 with imported flax seed. The seeds vary much in shape and size, being generally larger than those of Western False Flax, irregularly oval or oblong in outline, thickly flattened and pale yellow in colour. The plant may be distinguished by its early leaves, which are broadly dentate. The seed is found chiefly in flax seed.

Eradication.—False flax is propagated entirely by seeds. Prairie soils infested with this weed should receive a thorough disking or shallow ploughing in the spring before seeding. When a crop of winter wheat is infested, harrowing in the spring kills the young plants without injuring the wheat. Badly infested fields should receive a thorough summer-fallow with cultivation the previous fall.



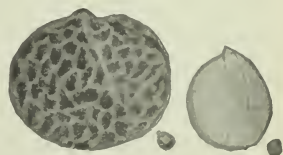
Flat-seeded False Flax

Small-seeded False Flax (*Camelina microcarpa* Andr.) resembles Western False Flax but is more slender and has smaller pods. The seeds are only about $\frac{1}{20}$ of an inch long, dark reddish-brown; scar of attachment a white point in a notch at the base of the seed. They often occur in large quantities in alsike and timothy seeds.

Small-seeded
False Flax

Eradication.—This weed does not long give serious trouble where a short rotation of crops is practised and where thorough cultivation and seeding to grasses is done with spring grains instead of fall wheat. The first crop of alsike in the fall wheat districts usually contains some false flax and should not be taken for seed unless the weeds are first hand-pulled and destroyed.

Ball Mustard (*Neslia paniculata* (L.) Desv.)—Introduced from Europe into the West about the same time as Tumbling Mustard, Hare's-ear Mustard and Cow Cockle. A tall annual or winter annual. Stems erect, very slender; strong plants throwing out a few long branches. Whole plant yellowish-green and covered with small, appressed, star-shaped hairs. Lower leaves lance-shaped, narrowed at the base; stem leaves arrow-shaped, clasping the stem at the base, blunt-pointed. Flowers small, $\frac{1}{8}$ of an inch across, orange-yellow. Ball Mustard is very prevalent in the Prairie Provinces. The seed is enclosed in small, round, one-seeded, shot-like pods, commonly called "seed," which are borne on slender foot-stalks, about $\frac{1}{12}$ -inch in diameter, roundish, greenish-brown,



roughly net-veined, somewhat like a small piece of dry earth. The contained seed is yellow, with the miniature root of the germ prominent. The whole pods are generally found in grain, as they do not open to discharge the seed.

Eradication.—Similar to Stinkweed and False Flax.

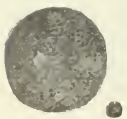
Wild Radish (*Raphanus Raphanistrum* L.).—Introduced from Europe. Abundant in the Maritime Provinces. Annual and winter annual, 1 to 2 feet high, with a few long branches starting low down. The root is slender, not swollen as in the garden radish. The plant resembles Wild Mustard but the flowers are fewer and larger, noticeably paler yellow and conspicuously veined. The constricted seed pods are the most distinctive characteristic; with these no mistake can be made in identifying the two plants. In Wild Radish the seed pods have no valves, but are composed of two joints, the lower one small, $\frac{1}{10}$ of an inch and seedless, which remains attached to the footstalk; the upper cylindrical, $1\frac{1}{2}$ inch long, with several one-seeded cells formed by transverse partitions. This seed-bearing



portion separates from the first joint, leaving it attached to the footstalk; in threshing, it is often broken up into single-seeded sections. The seed itself varies much in size and shape, being about $\frac{1}{8}$ of an inch long, oval, irregular, slightly flattened, reddish brown, the surface very finely netted. The seed pods are frequently found in grain, especially oats. Wild Radish is a coarse, vigorous weed, not less objectionable than Wild Mustard though less difficult to suppress. Grain crops polluted with it are troublesome to harvest as the bulky nature of the plants prevents the elevation of the grain in self-binders and greatly increases the amount of binder twine required.

Eradication.—Summer-fallow. Hoed crops with thorough cultivation. Rotation of crops.

Wild Mustard (*Brassica arvensis* (L.) Ktze.), and other wild Brassica species.—Wild Mustard is the commonest and one of the most injurious weeds belonging to the Mustard family. It is general throughout Canada in farm crops and waste places, being especially abundant along river valleys. It is an annual. Stems erect, branching, 1 to 3 feet high, rough, with stiff, somewhat downward directed hairs. The purple at the junction of the branches with the stem is a striking characteristic. Flowers bright yellow fragrant, $\frac{2}{3}$ -inch across. Seed pods 1 to 2 inches long, knotty or slightly constricted between the seeds, ribbed and rising obliquely on short, thick footstalks, tipped with a long empty or one-seeded, two-edged beak, which breaks away whole from the ripe pod. Each pod contains about 15 to 17 seeds. When ripe the pods split and much of the seed is left on the land at harvest time; thus



the plant rapidly increases on land devoted to cereal grains, particularly oats. The seeds vary somewhat in size, but are generally about $\frac{1}{16}$ of an inch in diameter, quite round, dark brown or reddish black, almost smooth to the naked

eye but slightly pitted under a glass and have a decidedly pungent taste. They are frequently found in great numbers in grain and occasionally they occur in small seeds. Among the other wild Brassicas, not so common, the seeds of which closely resemble those of Wild Mustard, are **Indian Mustard** (*Brassica juncea* (L.) Cosson), **Black Mustard** (*B. nigra* (L.) Koch) and **Bird Rape** (*B. campestris* L.).

Eradication.—Similar to Stinkweed. Avoid cereal crops where practicable.

Hare's-ear Mustard (*Conringia orientalis* (L.) Dumort). Introduced from Europe, probably with flax seed, about 1892. Annual and winter annual.

Stems erect, with few branches, 1 to 4 feet high. Whole plant perfectly smooth, and when young, covered with a fine bloom like that of cabbage. Leaves fleshy, without teeth, the root-leaves obovate, gradually narrowed to the base; those on the stiff stems, which become wire-like when ripe, oblong oval, shaped like a hare's or a rabbit's ear, clasping the stem by two rounded, ear-like lobes. Flowers creamy-white, $\frac{1}{4}$ -inch across. Pods square, 3 to 4 inches long. Hare's



ear Mustard is quite general throughout the Prairie Provinces, especially in southern Alberta, in grain fields, on stubble and by roadsides; spreading rapidly. The seed is dark-brown, rounded oblong, pointed at the scar end, $\frac{1}{12}$ of an inch long, granular

roughened; when soaked in water, covered with short, erect, white mucilaginous hairs. In shape it resembles the seed of common False Flax. The seeds are commonly found in western grain.

Eradication.—Similar to Stinkweed. A few years in meadow will greatly reduce this pest.

Tumbling Mustard (*Sisymbrium altissimum* L.).—Introduced into the Prairie Provinces from central and southern Europe about 1887. Annual and sometimes winter annual; 2 to 4 feet high, stem branching, the lower part of the root leaves downy and glandular, with a musky odour; upper part of the stem and the much divided leaves smooth. The young plants form a rosette of soft, pale green, downy leaves, shaped much like those of the dandelion. On the flowering plants the leaves change very much in shape from the root up, no two being alike. Flowers pale yellow, $\frac{1}{8}$ -inch in diameter. Seed pods 2 to 4 inches long, very slender, and produced abundantly along the branches. Each pod contains about 120 seeds, and a single plant has borne as many as 1,500,000 seeds. When the seeds are ripe the whole head of the plant breaks off and is blown across the prairie, scattering the seeds far and wide. The seeds,

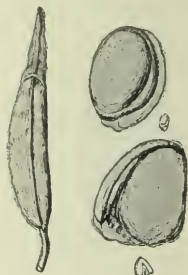


as in many "tumbling weeds," are not easily shed from the tough pods; consequently a head of this weed may blow about the prairie for a whole

winter, dropping a few seeds at intervals for many miles. It occurs in grain fields and along roadsides. The seed is small, $\frac{1}{25}$ of an inch long, olive brown or greenish yellow, minutely roughened with mucilaginous glands, oblong, angular, cut off transversely at the scar end, sometimes almost square from the compression in the pod, grooves conspicuously darkened. The miniature root of the germ is prominent and plainly visible through the thin skin.

Eradication.—Similar to that given for other mustards.

Rocket or Rocket Salad (*Eruca sativa* Lam.) has recently been introduced into Ontario, probably with European alfalfa seed, and is now frequently reported. It is a hairy annual, somewhat resembling Wild Mustard. The leaves are pinnatifid, with a large terminal lobe. The flowers are yellowish-white, characteristically netted with dark purple veins, aromatic. The pods are shorter than those of Wild Mustard, upright, the beak broad and flat. The seed is a little larger than that of Wild Mustard, flattened, olive brown, the miniature root of the germ generally lighter in colour. It is pungent and bitter, with a flavour characteristic of radish. The seed is occasionally present in European alfalfa seed. The plant is seldom referred to as a noxious weed in Europe but it should not be allowed to mature its seeds in cultivated crops. Many of our worst weeds have been introduced through imported seed and have become widely distributed through lack of care in preventing the



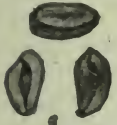
first plants from seeding. Prevention is easier than cure in dealing with any weed and as Rocket belongs to one of our most dangerous plant families it should be carefully hand-pulled wherever it makes its appearance so that it can not get a chance to ripen seed and become established.

Dog Mustard (*Erucastrum gallicum* (Willd.) O. E. Schulz.).—Although not recognized in Canada until recently, dog mustard is in practically all provinces, and northward to the Peace river. It is being found along railways and roadsides everywhere; and in at least one district in Manitoba has invaded fields to a serious extent. Loose soils or gravel appear to be its special preference. In such locations plants may form a considerable tangle of branches, elongating as flowers and pods develop. In less favourable places the habit is more erect. Thick, crisp leaves, of deeply scalloped outline are borne in abundance at the base of the stem, but diminish to mere leaf-like bracts within the inflorescence. The stem is beset with backwardly pointing hairs. Tortuous roots, more or less branched according to the substratum, anchor the plants, which are of one year's duration or possibly also winter annual. The flowers are of medium size for mustards, pale yellow, and borne on slender spreading pedicels; and are followed by slender pods about an inch and a half in length. The seed is about $\frac{1}{20}$ of an inch long and slightly less in diameter, with faintly sculptured surface, brown in colour and slightly darker tipped about the scar. The seeds are in a single row in each cell, and are produced in profusion on any well branched plant.

Eradication.—Hand-pulling before seed matures wherever first appearing; treatment as for other annuals under field conditions.

Green Tansy Mustard (*Sisymbrium incisum* Engelm., var. *filipes* Gray) is a native biennial occurring in grain crops in the Prairie Provinces and British Columbia and as a wayside weed in eastern Canada where it is common

along railways and where western grain or mill feeds have been distributed. In the first season it appears as a rosette of finely divided leaves lying on the ground. Stems 3 to 4 feet, erect, widely branching at the top and bearing an enormous number of narrow, smooth, slightly curved pods, from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch long, on slender, spreading footstalks. Whole plant bright green and somewhat glandular. Leaves pinnatifid, each division subdivided into 2 or 3 linear-oblong segments, with or without teeth. Flowers yellow, $\frac{1}{8}$ of an inch across in an elongated raceme. The seed is small, $\frac{1}{25}$ of an inch long, oblong, sometimes compressed at the scar end, reddish-brown, minutely roughened with mucilaginous hairs. The seeds occur in poorly cleaned western grain and occasionally in grass seed.



Grey Tansy Mustard (*Sisymbrium incisum* Engelm., var. *Hartwegianum* (Fourn) Watson) is similar to the above but greyer due to its being covered with short, grey, downy hairs. It has a more erect habit of growth, with pods much more crowded together. The seeds are similar to those of Green Tansy Mustard but ripen a month later.

These two coarse biennials grow only from seed but they throw out long branches from their white tap roots and draw nourishment from a wide area. As they stand considerably above the crop, they are a conspicuous advertisement of negligent farming.

Eradication.—The prevalence of these biennial mustards in grain fields of the Prairie Provinces is largely due to the practice of raising cereal grains on stubble land, with only surface cultivation in the fall or spring sufficient to produce a suitable tilth for a seed bed without first destroying the weed growth by ploughing, thorough disking or the use of the broad-shared cultivator. Summer fallows should receive clean cultivation until late in the fall. Waste places where it thrives should be sown to permanent grass and the weed growth kept cut until the grass has possession of the soil.



Worm-seed Mustard (*Erysimum cheiranthoides* L.) is a native annual and winter annual, frequently found in waste places and on cultivated land throughout Canada. Stems erect, simple or branching, 6 inches to 2 feet high. Leaves dark green, lance-shaped, sparsely toothed. Flowers bright yellow, $\frac{1}{2}$ of an inch across, in terminal clusters about 1 inch across, on gradually elongating racemes. Seed-pods slightly curved, from $\frac{1}{2}$ to 1 inch long, obtusely 4-angled, erect on spreading footstalks. Each pod contains about 25 seeds. An average plant will ripen about 25,000 seeds. The seed varies somewhat in size and shape, generally pointed at one end, rounded at the other, about $\frac{1}{4}$ of an inch long, reddish yellow, with a dull surface. The miniature root of the germ is conspicuous. The seeds are very bitter and on account of their very disagreeable taste some kinds of stock, especially hogs, will refuse to eat



chop made from grain containing any appreciable quantity of it. It is a common impurity of grain, alsike and timothy.

Eradication.—The seeds are short-lived, and so this mustard is kept under control on land worked under a short crop rotation with clean cultivation. Fall cultivation of stubble land, followed by disking in spring before seeding, will keep this pest in check.

Hedge Mustard (*Sisymbrium officinale* (L.) Scop.) is a common weed along roadways and waste places. It seldom gives serious trouble in fields. The plant is from 2 to 3 feet high and of a ragged appearance. Flowers small, pale yellow. Pods slender, hard and brittle; when mature, closely pressed to the few-branched stem. Seeds sometimes found in timothy seed. They resemble somewhat the seeds of Tumbling Mustard but are larger.

Eradication.—This weed is easily destroyed along roads and waste places by cutting to prevent it from seeding.

Small Wall-flower (*Erysimum parviflorum* Nutt.). Biennial or winter annual. A stoutish sparingly branched plant with yellow flowers and upright or spreading pods which are thicker but shorter than those of Worm-seed Mustard. Height from 10 to 20 inches. The seeds are about the same length as those of Worm-seed Mustard but average much wider and are squarer at the ends, practically never pointed. They are common impurities in western timothy. The plant sometimes causes injury to grain on poorly prepared fallow.

Western Wall-flower (*Erysimum asperum* DC.). Similar to the former but the flowers are much larger and the pods very long and widely spreading, often becoming horizontal when ripe. Seeds similar but less frequently met with.

Tower Mustard (*Arabis glabra* (L) Bernh.). A tall plant, lower leaves stalked, rough; upper leaves smooth, stalkless, somewhat arrow-shaped; flowers small and white; pods long, clustered closely around the stem. The seeds which are met with in timothy are flat, brownish and somewhat winged. Several closely allied species occur in Canada.

Spider-flower or Stinking Clover (*Cleome serrulata* Pudsh.) is a native annual, with erect stem, branched above and alternate leaves composed of 3 leaflets. Flowers pink or white, showy. The seed is round, wedge-shaped, with a deep curved groove running up each face two-thirds of the way to the top from just above the sharp-pointed base. When ripe it is dark brown, roughened with pale, scurfy protuberances; the dry unripe seed is yellowish. Occasionally found in western grain.

Upright or Rough Cinquefoil (*Potentilla monspeliensis* L.) is a native annual common in old meadows and worn-out sandy soils throughout Canada. It is erect, branching, rough-hairy. The three leaflets of each leaf are obovate; those of the top leaves, which are stalkless, are toothed nearly the whole length. The mode of flowering is a leafy, rather close, cyme of yellow flowers. The seeds are grouped together on the receptacle, which is long, thin and downy. The seed when ripe is leather-brown, dull, about $\frac{1}{30}$ of an inch long, bluntly comma-shaped, with curved branching veins running longitudinally. Commonly found in timothy and alsike and occasionally in red clover seed.

The genus *Potentilla* is widely distributed, comprising many species closely related to the Upright Cinquefoil, as *Potentilla monspeliensis* L., var. *norvegica* (L.) Rydb, also commonly



called Upright or Rough Cinquefoil. It is distinguished by less hairiness and by somewhat more narrowly oblong leaves. Both occur in similar situations

and have about the same distributive range. The seeds of the cinquefoils are very similar and their identification is sometimes difficult. They vary only slightly in size and in the roughness of the net-like veins covering the surface, which sometimes are not apparent, especially when the seeds are not ripe. Another species of this genus which is sometimes found in moist land is Silverweed (*Potentilla Anserina* L.), occasionally mis-named Buttercup. It is a perennial with slender, jointed runners, which root and form new plants at each joint, like the strawberry. The leaves, silvery, hairy beneath, are composed of from 3 to 10 large, oval, sharply-toothed leaflets on each side of the stalks, with very small ones between them. The long-stalked, golden-yellow flowers, nearly an inch across, are followed by a cluster of dry, smooth seeds. **Silverweed** roots on the surface of the ground and is best controlled by draining the land and ploughing down the plants.

White Cinquefoil (*Potentilla arguta* Pursh.). Perennial, upright; very hairy; flowers much clustered; white; not unlike those of strawberry. Seeds very small; smooth, pinkish brown and pointed at one end. It may at once be separated from our other Cinquefoils by its white flowers and the seeds by their smallness. A rather common impurity in western timothy but is seldom troublesome unless the land has been sown down several years.

Eradication.—Ploughing at any time of the year. Proper drainage and short rotation of crops.

Prairie Roses (*Rosa pratincola* Greene or *Rosa arkansana* of Canadian writers, which includes *Rosa acicularis*, var. *Bourgeauiana* Crepin) are sometimes troublesome in parts of the Prairie Provinces. In Southern Manitoba this dwarf, large-flowered rose is very persistent. Its deep perennial rootstalks send up many flowering shoots from the axils of the scales. The seeds vary greatly in size and shape, averaging about $\frac{1}{2}$ of an inch long, generally irregular-angular, with hard, yellowish shells. They are often found in the screenings of western grain and quite frequently in seed wheat. To destroy roses the land should be ploughed with a sharp plough in hot weather and then double disked at intervals of a week or ten days.



Sweet Clovers—Introduced from Mediterranean Europe, where for centuries they have been grown for forage and as honey plants. They should be considered as weeds when they grow where they are not wanted. Their good qualities are many but they differ in their qualities and habits from the commonly cultivated clovers and must be handled differently. Therefore their seeds are considered as impurities in the seeds of other crops.

White Sweet Clover (*Melilotus alba* Desr.) is much more prevalent than the yellow species. Stems from 3 to 10 feet tall, somewhat woody, many branched; leaves pinnately three-foliate, the leaflets very finely toothed; flowers in long, slender, one-sided racemes, white and very fragrant. The pod is thin, small, egg-shaped, covered with a network of ridges and having a short stiff point at the top. The seed is hard, small, $\frac{1}{8}$ of an inch in length, smooth, dull yellow, evenly egg-shaped with a V-shaped light mark running from the scar.



Yellow Sweet Clover (*Melilotus officinalis* (L.) Lam.) is a smaller plant, with stems 2 to 5 feet tall. The flowers are bright yellow, slightly larger but less fragrant than those of the white species. The plant often flowers a week earlier and holds its bloom somewhat later than white sweet clover, which makes it more valuable as a honey plant.



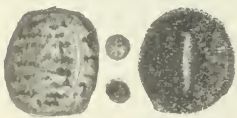
Black Medick (*Medicago lupulina* L.), introduced from Europe, annual, is a common weed in clover fields and lawns, thriving in moist soils. It grows from 6 to 18 inches in height, hardly erect, much branched, sometimes hairy, leaves bright green, small, of 3 leaflets. Flowers small, bright yellow in short close spikes, $\frac{1}{8}$ to $\frac{1}{4}$ of an inch long, becoming longer in fruit. Usually the bright flower heads and black cluster of fruit may be seen on the same plant as the seeds ripen quickly. The pod is thin, small, not more than $\frac{1}{8}$ -inch long, kidney-shaped with one end coiled, dark brown or black, rough-ridged, the main ridges following the outline of the pod. There are sometimes 30 pods in one cluster, but each pod contains only one seed. The seed is little more than $\frac{1}{16}$ of an inch long, hard, smooth and somewhat shining, egg-shaped rather than kidney-shaped, yellow to pale



olive-green. It has a sharp projection near the scar from which a light line runs towards the larger end of the seed. It is found frequently in commercial samples of red clover, alsike and alfalfa. In alfalfa and red clover it is usually found in the pod. It is sometimes used as an adulterant in clovers. The seeds of Sweet Clover and Black Medick are sometimes confused with each other and with alfalfa seed. They are both thicker and shorter, being egg-shaped, while alfalfa seed is kidney-shaped or sometimes irregularly angled. Sweet Clover seed may be distinguished from Black Medick by its larger size and the V-shaped light mark running from the scar. With Black Medick there is a sharp projection near the scar from which a light single line runs towards the larger end of the seed.

Eradication.—Of value for sheep pasture. Hoed crops.

Wild Vetch or Wild Pea (*Vicia angustifolia* (L.) Reichard) is an introduced annual widely distributed in cereal crops and as a wayside weed in Eastern Canada. The plant is hairless or downy. Stem slender, simple or branched at the base. Leaves are composed of 2-5, rarely 6, pairs of linear or lance-shaped leaflets. Flowers $\frac{1}{2}$ to $\frac{3}{4}$ inch long, purple, 1 or 2 in the upper axils of the leaves. Pods black and linear with the tips sharp and turned upwards, 2 inches long, 4 to 12-seeded. The seed is round, ranging from $\frac{1}{10}$ to $\frac{1}{6}$ of an inch in diameter, velvety black or olive brown, mottled with white and dotted with fine, black spots; the whitish scar is about $\frac{1}{5}$ the circumference of the seed in length, thin, threadlike. The seeds are a common impurity in grain grown in the Maritime Provinces, Quebec and parts of Ontario. They are especially objectionable in



oats required for milling. A short rotation of crops designed to prevent Wild Tare from seeding will suppress it.

Wax-ball or Three-seeded Mercury (*Acalypha virginica* (L.) is a native annual common in river flats and low fields in Ontario and eastward. It is a leafy plant 1 to 2 feet high, with long-stalked, ovate leaves. It gives trouble in pastures, meadows and fields. On account of its acrid juice it is avoided by live stock and entails considerable waste wherever it occurs. The seed is about $\frac{1}{16}$ of

an inch long, comparatively soft, with a thin coat finely striated, grey to yellow brown spotted with dark brown, sometimes reddish brown free from spots. It is ovoid, pointed at one end, rounded at the other. There is a dark slightly raised line running from the round end of the scar on the same side of the seed. The scar is one-third the length of the seed, oblong, raised and white. The seeds are quite frequently found in clover seed.

Sun Spurge (*Euphorbia Helioscopia* L.) introduced, is an erect annual, abundant in Eastern Canada. Mode of flowering, nearly flat-topped, umbrella-like, surrounded at the base with a whorl of stalkless, obovate, finely and thickly dentate leaves. Pod or capsule smooth and even, 3-lobed. The seed at first sight somewhat resembles the pods of Ball Mustard in miniature. When examined closely, however, it is easily recognized. It is rounded oval in outline, rolling freely on a smooth surface, a little flattened on one face, with a sharp central ridge running to the apex. The sides of the seed are not angled, the whole surface coarsely matted; scar kidney-shaped, white and very conspicuous. The seeds are seldom found in commercial samples. Sun Spurge is a common weed in gardens and waste places, being most troublesome on light, sandy soils.

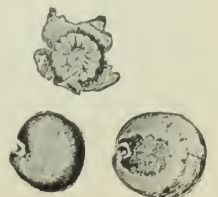
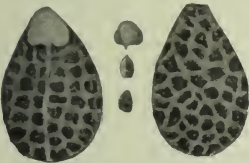
Eradication.—Special care is required to prevent the ripening of seed late in the summer. It will not long trouble lands worked under a short rotation with clean cultivation.

Leafy Spurge (*Euphorbia Esula*) a perennial not indigenous to Canada. Characterized by deep spreading roots, pale green foliage 2-3 feet high with many narrow leaves and with milky juice; flowers yellowish, small in flat topped clusters; pods three-seeded, seeds grey, oblong and smooth. Flowers appear in late June and early July. Spreads both by seed and roots.

Eradication.—It has been found very difficult to eradicate. This plant is comparatively new and small areas should be hoed repeatedly to prevent any growth. For larger areas plough about 3 inches deep and pack the middle of July and keep black till freeze-up. If no green leaves are allowed to form complete eradication will result.

Round-leaved Mallow, Low Mallow or Cheeses (*Malva rotundifolia* L.) Naturalized from Europe. Biennial. Low and spreading from a deep

root branched from the base, stems 6 to 18 inches long. Leaves round-heart-shaped on long and slender stalks, margin scalloped and toothed. Flowers in threes or fours in the angles of the leaves, on slender flower-stalks, $\frac{1}{2}$ to $1\frac{1}{4}$ inches long. Flowers about $\frac{1}{2}$ -inch wide, white, sometimes tinged with blue or pink. The fruit is made up of about 15 seed vessels arranged in a ring, $\frac{1}{4}$ of an inch in diameter and called the cheese (see illustration). The seed with its light-coloured outer coat on is a little more than $\frac{1}{16}$ of an inch and a little less with the coat off. The seed itself is hard, smooth, almost round, with a small piece out of one side of it; it is grey to dark brown in colour with a white line



around the scar. It is found in clover samples both with and without its outer coat. **Spiny Sida** (*Sida spinosa* L.), a profusely branched herb, about 1 foot high, covered with soft hairs, is another weed of secondary importance belonging to the mallow family. The leaves are oblong or egg-shaped on long footstalks, dentate, with sharp teeth pointing forward. The flowers are greenish-yellow, small and shaped like those of the Hollyhock.

Eradication.—Good drainage. Hoed crops. Pasture with sheep.

Common St. John's-wort (*Hypericum perforatum* L.) introduced from Europe, is common in pastures, old meadows and roadways from Nova Scotia to Ontario. Perennial by runners at the woody base of the erect, much-branched, somewhat 2-edged stem. Leaves opposite without teeth or divisions, elliptic or linear oblong, black-dotted along the margin like the corolla divisions. Flowers deep yellow, grouped into terminal, loose cymes. The seeds are borne in three-celled, ovoid pods. They are about $\frac{1}{25}$ of an inch long, cylindrical, rounded at the ends, with a minute point. The surface is rough, pitted, a little shiny, dark brown to black in colour. The seeds occur very rarely in grass seeds. Some allied species are quite common in different parts of the country. **Great St.**



John's-wort (*Hypericum Ascyron* L.) is a common, coarse-growing weed in low rich soils and about swamps in Quebec and Ontario, occasionally occurring in old meadows and pastures along river flats. **Spotted or Corym-**



bed St. John's-wort (*Hypericum punctatum* Lam.) about 2 feet high, is abundant in the Bruce peninsula of Lake Huron and quite general throughout Ontario, Quebec and eastward to Nova Scotia. **Pale St. John's-wort** (*Hypericum ellipticum* Hook), with its bright yellow flowers, is common in Quebec, Northern Ontario, and westward to Lake Winnipeg.

Eradication.—Avoid grass crops. Repeated close cutting in waste places.

Common Evening Primrose (*Oenothera biennis* L.) is a tall, coarse biennial which occurs throughout the country and is easily recognized by its tall, branching habit (4 ft. by 3 ft.), its soft, downy, lance-shaped leaves, and its large, showy, yellow flowers which open in the evening. This species makes only a rosette of leaves the first year. For this reason it appears only in crops sown in autumn or on stubble. In thin clover fields it sometimes occurs conspicuously and should be either spudded out or cut off below the crown in the first season; or the tall flowering plants should be



cut off below the surface and pulled out before the seeds ripen. The seeds are produced in large numbers in long, tapering, 4-edged capsules, 2 rows of seeds in each cell, which are clustered all along the stems. They are about $\frac{1}{16}$ of an inch long, dark reddish-brown, and with a roughened surface much angled by compression in the pods. They are a very

common impurity in clover and grass seed, being especially abundant in timothy. As the pods do not easily shed their seeds and the plants are at all times conspicuous, much contamination of seed crops may be prevented by a little care at harvest time.

Eradication.—Prevent seeding.

White Evening Primrose (*Oenothera pallida* Lindl.) is a native perennial occurring in Manitoba and westward to British Columbia. It is deep-rooted and very persistent in sandy land. The roots are white and fleshy, wide-spreading and throwing up flowering stems at intervals, thus forming large patches. Stems mostly simple, shining white, sparsely downy above, erect or nearly so, about 3 feet high. Leaves from 1 to 4 inches long, narrow and waved, sometimes pinnatifid but usually without teeth or divisions in plants found in the West. Flowers axillary, large and



handsome, $1\frac{1}{2}$ inches across, waxy-white, turning pinkish as they fade, open in day time, odour unpleasant. Tips of the calyx divisions at the ends of the buds free, as 4 little points. Capsules narrow and curved, 4-angled, about 1 inch long with the seeds in

single rows in each of the four cells. The seed is about $\frac{1}{16}$ of an inch long, normally spindle-shaped but angular and somewhat twisted by compression in the pod, smooth and mucilaginous when soaked, yellowish-brown; under microscope minutely dotted with black and faintly striate lengthwise; not found in commercial samples.

Eradication.—Plough and summer-fallow after hay crops.



Spotted Cowbane or **Water Hemlock** (*Cicuta maculata* L.) is a native perennial occurring in low land along waterways. Stems stout, erect, hollow and jointed, widely branching, 3 to 6 feet high, quite smooth, pale green, dotted and streaked with purple. Root, a bundle of a few fleshy, spindle-shaped tubers, like small parsnips. Leaves compound, in 2 or 3 divisions, clasping, by an expanded base, the lower leaves on long footstalks, the upper stalkless. The leaflets lance-shaped, deeply toothed. Flowers small, white, in compound, umbrella-like clusters 1 to 4 inches across; the little footstalks of the many flowered secondary clusters unequal, from 1 to 2 inches long. The seed is $\frac{1}{12}$ of an inch long, smooth, ovate, compressed on the sides, separating into boat-shaped, ribbed halves. When cut across, the seeds show four oil tubes between the ribs and two on the flat side. They do not occur in commercial samples. The roots

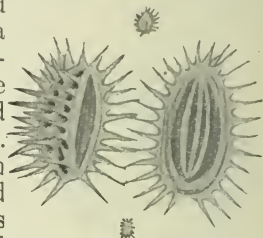


are intensely poisonous to stock, particularly cattle, which pull them out and eat them freely when grazing in spring. The roots look like small parsnips and, like them, have a strong aromatic odour, apparently attractive to stock. It is claimed that the flowering plants, when cut with hay, may be eaten by animals without any ill effects, but that the seed-bearing plants are dangerous. Hand pulling is the most effective remedy.

Wild Carrot (*Daucus Carota* L.).—Introduced from Europe and now spreading rapidly in the clover seed producing districts of Ontario. It is an objectionable weed along roadsides, waste places and old meadows and occasionally gives trouble in cultivated fields. Biennial, with a large succulent root. Stems, flowers and leaves as in cultivated carrot. The fruit when ripe separates into two seed-like halves, commonly called seeds, each having 5 inconspicuous ribs running lengthwise and 4 winged secondary ribs bearing a row of barked prickles which are easily rubbed off. The true seed is inside the fruit. The seed in the fruit is becoming quite a common impurity in Canadian-grown red clover seed, but is more frequently found in imported stock. It seldom occurs in alsike.



Eradication.—Wild Carrot can best be kept in check in cultivated fields by a regular rotation of crops with thorough cultivation of hoed



crops. Old meadows infested with it should be broken up and cultivated for a few years. Sheep will help to suppress it in pasture lands.

Small Gentian (*Gentiana Amarella* L. var. *acuta* (Michx.) Herber). A native annual, one-half to two feet high. Lower leaves obovate, upper lanceolate or narrowly oblong, stalkless, clasping. Flowers numerous, tubular blue; seed less than $\frac{1}{25}$ -inch in diameter, light brown, spherical with a small depression in one side. A common impurity in western timothy. This seed may be easily cleaned out of timothy by the use of a fine wire mesh sieve.

Field Bindweed (*Convolvulus arvensis* L.).—Introduced from Europe Perennial, deep-rooting, with extensive, creeping, cord-like fleshy rootstocks;

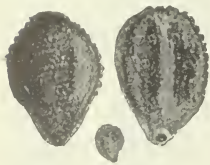
these throw up numerous slender branching and twining smooth stems, which form thick mats on the surface of the land and twist around any plants growing within reach, using them as supports and choking them out. Leaves about 1 to $1\frac{1}{2}$ inches long on slender stalks, ovate or heart-shaped, arrow-shaped at the base. Flower-stalks slender, about the same length as the leaves, provided with miniature leaves at some distance below the large, open, funnel-shaped

pink flowers, which are over an inch across. Fruit a round, cartilaginous, 2-celled capsule containing 3 to 4 seeds. The seed is rather large, $\frac{1}{6}$ of an inch long, dark brown, pear-shaped; one face convex, the other bluntly angled with flat

sides. Surface roughened with small tubercles; the basal scar is a roughly lined, reddish depression at the lower pointed end. Field Bindweed is exceedingly hard to eradicate because of the almost incredible persistence of the fleshy rootstocks. Although widespread throughout the Dominion and in restricted localities very troublesome, it is not yet a very common weed in Canada. The seeds are not often found in grain or clover seed. The plant propagates mostly by rootstocks and in many localities produces few seeds.

Eradication.—Persistent cultivation to prevent leaves forming. Smother small patches with straw or manure.

Common Milkweed (*Asclepias syriaca* L.). This is a native weed ranging from New Brunswick to the prairies, but reaching its peak of abundance in the



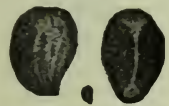
older settled parts of Ontario, where it is sometimes of major importance. While especially prevalent in pastures, it often persists strongly as a coarse pest of rich arable land. Its fleshy root system ramifies extensively through some depth of soil, producing buds at as frequent intervals as there is room to maintain plants. It breaks readily into pieces which drag to other parts of the field, capable of sprouting and quickly forming new stands. The stems are stout, two to four feet tall, with large thick oblong leaves, borne mostly in pairs. All parts of the plant are filled with an acrid white latex, which gives the plant its name. Each stem bears one or more umbels of curiously shaped green-purple flowers. Follicles, beset with soft teeth and tapering to a point, contain a great number of seeds compactly stowed away within, together with silky attachments which serve to waft the quite good-sized seeds away upon the bursting of the follicles. The seeds are brown, flattened and nearly pear-shaped in outline, with a crisped border all around.

Eradication.—In pastures cut to prevent its seeding at least. In fields plough and treat about as for Canada thistle.

Hedge Bindweed or Convolvulus (*Convolvulus Sepium* L.). Perennial, spreading by thick underground rootstocks which break into lengths by cultivation and readily grow when covered. The trailing or twining stems are three to ten feet or more in length. Flowers large and showy, pink with white stripes, or clear white. Just below the flower and overlapping and concealing its five-lobed calyx is a pair of large heart-shaped bracts, which are persistent and enfold the fruit. It can be distinguished from the Field Bindweed by these bracts. The seeds are not unlike those of Field Bindweed but average nearly twice as large. This is a very persistent weed in lowlands, particularly in parts of Manitoba.

Clover Dodder (*Cuscuta species*).—Introduced from Europe. An annual parasite with slender yellowish and reddish stems, which twine about the host plant and become attached to the clover stems by suckers through which it obtains nourishment from the host. Flowers whitish or pinkish, in clusters along the thread-like, twining stems. There is probably no weed legislated against so much as Dodder. It is a serious pest in southern Europe, parts of the United States, Chili, and other temperate to warm climates having long summer seasons without frost. During the years of shortage in clover seed crops in Canada it has frequently been introduced and widely distributed in imported seed; but its ravages have been noted on red clover in only a few instances, and those

in southern Ontario and the Pacific coast in years following an exceptionally late fall without frost until October. The seed is small, from $\frac{1}{30}$ to $\frac{1}{20}$ of an inch in diameter, yellow or brown, irregularly spheri-



cal and more or less angled on the inner scar-bearing side; the surface granular roughened. Alfalfa Dodder has given trouble in Southwestern Ontario and in the Prairie Provinces, where it is known to have continued in alfalfa for three years. Dodder has also given much trouble to Vetch growers in the Montreal district in recent years.

Eradication.—Badly infested fields should be ploughed under before seed forms. Small patches may be cut out and destroyed.

False Phlox (*Gilia linearis* (Nutt) Gray). Annual or winter annual, six inches high with pointed leaves and small pinkish flowers clustered in a terminal head. The seeds which occur in western timothy slightly resemble those of Ribgrass but are darker and roughened, while instead of the opening on one side there is only an elongated narrow groove. They are larger than timothy and should not be difficult to clean out. This seed and that of Small Gentian

are often found in timothy seed from Western Canada. Neither persists in cultivated fields.

June Weed (*Ellisia Nyctelea* L.). A low spreading annual with pinnately divided leaves and small bell-shaped bluish white flowers. The seeds are very like Cow Cockle but when viewed through a lens show a fine net-like surface instead of the granulated one found in Cow Cuckle. The plant takes less than two months to reach maturity and does all its injury in June; hence the name June Weed. In ripening it turns a characteristic black colour and is thus readily recognized even when dead.

Eradication.—Late spring ploughing and cultivation when the plants are small.

Blue Bur or Stickseed (*Lappula echinata* Gilibert).—Introduced from Europe. Annual and winter annual. Erect, branching, whole plant covered with short white hairs, which give it a greyish appearance. Leaves linear-oblong; root-leaves about 3 inches long, narrowed at base; stem-leaves stalkless. Flowers small, about $\frac{1}{8}$ -inch across, pale blue, erect, in leafy, more or less one-sided racemes, and with minute bracts. It occurs by roadsides, in waste places, and in some sections in cultivated fields in Eastern Canada and is a pernicious weed in fields of grain sown on stubble lands in the Prairie Provinces. The seed is about $\frac{1}{8}$ -inch long, dark brown, pear-shaped, with a rough surface, inner face sharply angled, outer face rounded, without spines in the centre, but having on the sides a double series of long stiff spines, each of which has at its apex a star of 3 or 4 sharp hooks. This nutlet is often found in clover and other commercial seeds, when many of the long barbed



bristles may be rubbed off; but it may be recognized by the angled inner face, with the small basal scar at the bottom of the central ridge and the unarmed area on the outer face. The seeds adhere to passing animals, bags, and clothing, and are spread in this way.

Eradication.—Fields badly infested with Blue Bur should be summer-fallowed. Thorough spring cultivation with the disk or broad-shared cultivator, or shallow ploughing, is necessary to prevent its abundant occurrence in crops sown on stubble land. Hand-pull from clover and grass crops.

Pigeon Weed or Corn Gromwell (*Lithospermum arvense* L.) is abundant in Western Ontario and troublesome in fields of fall wheat. It is a widely branching biennial or winter annual with white flowers and produces a large number of early-ripening seeds. The plants should be hand-pulled when practicable. The seed is similar in size and general shape to that of Blue Weed, but rather less angular and with a much smoother surface. Instead of having rough projections, it is deeply and irregularly grooved, with prominent ridges between the grooves. It may be easily recognized by the basal scar, which is oval or obtusely 3- to 5-angled; instead of the pit at the inner angle and the two cone-shaped projections on a concave surface, it has a convex surface with two light-coloured



distinct cones. These seeds are common in poorly-cleaned fall wheat and rye and are occasionally found in clover seed.

Eradication.—Land is best cleaned of Pigeon Weed by a short rotation, including grain sown in the spring instead of autumn, and well cultivated hoed

crops. Plants which start growth in autumn can be destroyed by fall or spring ploughing or disking.

Blueweed (*Echium vulgare* L.).—Introduced from Europe. Biennial, with a deep, black taproot. Whole plant bristly hairy, red at the base of the stiff bristle on the stem. Flowering stems erect and wand-like, forming compound spikes of reddish buds and bright blue flowers, 1 to 2 feet high; the spikelets curved at the tips, as is usual in the Borage family. Root-leaves linear-oblong or linear-lance-shaped, narrowed at base, without teeth or divisions, bristly hairs above and below, 6 to 8 inches long, the first year forming dense rosettes of long leaves lying flat on the ground; leaves of the flowering stems stalkless. Common by roadsides and in waste places and fields throughout Ontario and the eastern provinces, chiefly on limestone and gravelly or poor soil. The seeds from each flower are $\frac{1}{8}$ -inch long, dark brown, hard and rough, irregularly angular and cone-shaped, sharply



angled on the inner face and rounded on the outer, with a keel running from the sharp apex half way down the outer convex face; basal scar a large, flat, triangular surface, acutely margined, marked with two little cone-like projections and a small deep depression close to the inner angle. They occur quite frequently in clover seed.

Eradication.—Keep closely cut and thus prevent seeding. Short rotation of crops with fall ploughing and thorough spring cultivation.

Small Bugloss (*Lycopsis arvensis* L.) a European weed becoming common in some fields in Eastern Canada which are inclined to be dry or sandy. The plants are annual but capable of so polluting the soil with seed that it is extremely difficult to hold in check. The stems reach a foot or more in length, are rather succulent and weakly upright, and rough-bristly. The small blue flowers are borne in leafy clusters, and are succeeded by rough wrinkled nutlets in fours within the calyx.

Eradication.—Repeated shallow cultivation, as for other annuals. Intertillage.

Blue Vervain (*Verbena hastata* L.). A tall perennial from 4 to 6 feet high; leaves stalked, lance-shaped, taper-pointed, with sharp, forward-pointed teeth. Flowers violet-blue, small, borne in cluster of spikes at the summit. The seed is brown except the large, whitish basal scar at the bottom of the inner face. The outer face is convex, irregularly ridged lengthwise and sharply angled at the sides. The inner face slopes to the margin from a sharply-angled central ridge. The seed is found in timothy and other grass seeds. Blue Vervain grows in rich soil in moist situations. It seldom gives trouble except in low grounds and may be eradicated by draining the land and cultivating it thoroughly.



American Dragonhead (*Dracocephalum parviflorum* Nutt.) is a native annual or biennial quite widely distributed in the Prairie Provinces. The seeds are much like those of Hedge Nettle, but longer ($\frac{1}{8}$ -inch) and narrower, being twice as long as wide, more angular and somewhat winged and wrinkled along the angles near the apex. The basal scar is large and curved, with a slit in the middle, giving it the appearance of a mouth; colour dark brown; the outer convex face

distinctly ridged lengthwise and granular roughened. The seeds are frequently found in western grain, being very common in wheat screenings; they occur occasionally in grass and clover seed. American Dragonhead will not long give trouble on well cultivated land.

Hemp Nettle (*Galeopsis Tetrahit* L.), an introduced annual, is a common weed around barns and in rich damp soil in grain fields in all settled parts of Canada. It is very prevalent in the grain fields of Prince Edward Island. The stems are erect, tall, swollen below the joints, rough hairy. Leaves ovate, with strong, forward-pointing teeth, tapering at the end, on slender footstalks. Flowers, purplish, white or variegated, grouped into nearly stalkless clusters at the axils of the leaves; corolla dilated at the throat, about twice as long as the calyx; the teeth of the latter needle-pointed, bristly. The seed closely resembles that of cultivated hemp, though smaller, about $\frac{1}{8}$ of an inch long. It is broadly egg-shaped in outline, one surface rounded, the other bluntly keeled from the round, flat, depressed scar up to the



middle. The whole seed is greyish-brown, wrinkled from unevenly scattered, whitish tubercules. The seeds are quite common in grain grown in the Maritime Provinces and are occasionally found in alfalfa and red clover seed.

Eradication.—Drainage followed by thorough cultivation; keep closely cut or hand pull in waste places.

Hedge Nettle (*Stachys palustris* L.) is a native, occurring in moist lands throughout Canada. A secondary weed in Eastern Canada and Northern Alberta, giving trouble only in moist, low lands in grain fields and meadows. It is perennial by a tuber-like rootstalk producing many runners. Stem erect, leafy, its edges with coarse, downward turned hairs. Leaves stalkless, lance-shaped, oblong, tapering at the apex, round at the base with rounded teeth, hairy. Flowers pale red or spotted, formed into long, interrupted spike of 6 to 10 flowered whorls at the axils of leaves; calyx half the length of the corolla, bristly hairy, with spiny teeth. The seed is a dark brown or black nutlet, about $\frac{1}{12}$ of an inch long, egg-shaped, pointed at the base, which bears a small, shrunk scar. The one side is sharply keeled from the scar up to two-thirds the length of



the seed; surface dull, finely wrinkled. The seeds are found abundantly among screenings of western wheat, quite frequently in seed grain and occasionally in clover and grass seed.

Eradication.—Good drainage, clean cultivation with short rotation of crops, will check this weed and enable cultivated crop to smother it out.

Heal-all or Self-heal (*Prunella vulgaris* L.) is a native perennial which reproduces by running rootstalks. It is widely distributed over the continent in woods and fields but is not a very dangerous weed. The seed is about $\frac{1}{16}$ of an inch long, brown, slightly glazed, longitudinally striped, egg-shaped, sharply pointed at the base, which bears a white, heart-shaped scar with a deep depression in the centre. The seeds are quite a common impurity in red clover and grass seed and are occasionally found in alsike seed and alfalfa. Heal-all, like most other members of the Mint family, is not of great importance in agriculture as a weed and will not remain long or give serious trouble in land that is well cultivated under a short rotation including hoed crops.



Toad Flax (*Linaria vulgaris* Hill.), introduced from Europe, is quite common in Eastern Canada and spreading rapidly, especially in light and shallow soils. It is a persistent weed in waste places, roadsides, meadows and crops, being perennial and deep-rooted. The stems are erect, slender, becoming wiry. Whole plant hairless, slightly waxy. Leaves stalkless, extremely numerous, mostly alternate, linear, without teeth or divisions, acute at both ends. Flowers nearly an inch long, showy pale yellow with orange lips, borne in erect dense racemes; two-lobed corolla closed and mouth-like, but by a gentle pressure at the sides it opens and closes like the muzzle of an animal. The seed is about $\frac{1}{12}$ of an

inch in diameter, including the wing, dark brown to black, flat, round or oval, disk-like, roughened with tubercles and surrounded with a circular wing, as broad as the seed itself, finely radiate. The seeds seldom occur among crop seeds.



Eradication.—See “shallow cultivation method” under “Perennials,” page 15. Badly infested meadows or pasture lands should be brought under cultivation by ploughing in July, summer-fallowing until autumn and planting with hoed crop the following spring.

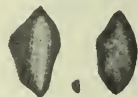
Ribgrass (*Plantago lanceolata* L.).—Introduced from Europe. Perennial or biennial. Rootstock short. Leaves numerous, 2 to 12 inches long, narrowly lance-shaped and distinctly 3 to 5-ribbed, hairy, with tufts of brownish hair at the base. In the first year the leaves lie close to the ground, forming a dense rosette; on old plants they are erect. Flower stalks stiff, slender and grooved, 1 to 2 feet, much taller than the leaves. Flower heads at first ovoid and rather showy by reason of their numerous yellow stamens, elongating with age and forming dense, cylindrical, black spikes of seed from 1 to 4 inches long. It occurs throughout Canada; most abundant in clover crops. The seed is about $\frac{1}{16}$ inch long, chestnut brown, minutely granular-roughened but highly polished, boat-shaped with rounded ends, the outer



face rounded with the edges folded inward around a deep, longitudinal groove, in the centre of which lies the dark-coloured scar which sometimes has a pale ring of dried mucilage around it. Ribgrass seeds are one of the most common impurities in red clover seed and are found less frequently in alsike and alfalfa seed.

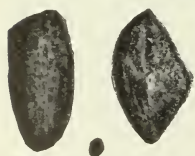
Eradication.—Use clean seed. Short rotation of crops.

Common Plantain (*Plantago major* L.) is a native perennial which occurs throughout the Dominion generally, in rich, moist soil, often in lawns and door-yards. Rootstock short and thick, bearing many thick-spreading roots and a large tuft of dark green, oval, long-stalked, coarsely-toothed, spreading or upward curving leaves, strongly nerved underneath, and several dense spikes, 3 to 12 inches long, of inconspicuous flowers with purple stamens. Seed capsules oval, dividing about the middle. The seed is about $\frac{1}{20}$ of an inch long, greenish-brown, variable in size and shape according to the number in the capsule (which varies from 8 to 16) rounded on the outer face, angular on the inner scar-bearing face; scar pale and conspicuous. The surface of the seed is finely netted with dark brown broken waved lines, which radiate from the scar. The seeds are a common impurity in timothy and clover



seed. Common plantain occurs in various forms, some of which may be distinct species, as indicated by the difference in habit of growth and degree of hairiness. It is found throughout the Dominion, generally in rich moist soils.

Pale Plantain (*Plantago Rugelii* Dcne.) often occurs with Common Plantain. It is a rather larger plant with more erect, smooth leaves, of a paler or yellowish-green, the leaf-stalks purple at the base. The spikes are longer and the flowers less crowded, the capsules more pointed, 4 to 9-seeded, opening below the middle. The seed is of the same angular shape as that of the Common Plantain but about twice as large and nearly black, with the surface merely roughened, not lined and netted. It is very common in timothy and alsike seed, even more so than Common Plantain seed.



Bracted Plantain (*Plantago aristata* Michx.) is a western annual which is rather rare in Canada, although its seeds are occasionally found in grass and clover seeds. The whole plant is downy; leaves narrow, linear, grass-like; flower-stalks erect, bearing thick, cylindrical spikes 1 to 4 inches long with conspicuous, pointed bracts. Capsules 2-seeded. The seed is boat-shaped, of the same size and form as that of Ribgrass but slightly wider, with sharper edges to the margin of the inner face. The elongated scar consists of two small, shallow pits lying close together in the centre of the inner excavated face, the whole of which is whitened by a coat of dried mucilage. The round outer face has a distinct shallow groove crossing it just below the middle. This groove and the two pits of the scar are the best characteristics for distinguishing this seed.



Eradication.—All the plantains are difficult to eradicate from lawns when they become established. They may be weeded out when the soil is firm by forcing a small implement like a chisel, with a half-round blade having a point like a spoon, between the soil and the fleshy crown of the weed to a sufficient depth to break the plant away from its fibrous roots without disfiguring the turf.

Narrow-leaved Goldenrod (*Solidago graminifolia* (L.) Salisb.), is a native perennial with running rootstocks which occurs in low land throughout the Dominion. The stems are erect, branching above into cymes, 2 to 3 feet high, almost smooth. Leaves numerous, linear-lance-shaped, 1 to 5 inches long, the edges rough-hairy. Separate heads of flowers about $\frac{1}{4}$ -inch across, bright golden-yellow, in dense flat-topped clusters. The seed is small, white, about $\frac{1}{12}$ of an inch long, ovate-oblong, nearly cylindrical, slightly tapering, many-ribbed, downy. The pappus is white, consisting of a single row of rough bristles, about twice the length of the seed. Goldenrod seeds are seldom found in commercial samples, but are blown long distances by the wind. The plant spreads locally by running rootstocks and if left undisturbed soon forms large patches. Several other goldenrods are rather troublesome free-growing perennials; among them are



Tall Hairy Goldenrod (*Solidago rugosa* Mill.) with long hairs, crowded leaves and a broad pyramidal panicle. **Tall or Canada Goldenrod** (*Solidago canadensis* L.) and varieties, with a slender stem, hairless at the base, and thin, narrow-lance-shaped leaves; and **Smooth Goldenrod** (*Solidago serotina* Ait.) with stout, smooth stems, leaves smooth on both sides. These showy autumn-flowering plants are wayside and grass-land weeds and do not give trouble on fields under regular cultivation.



Fleabanes (*Erigeron* species). A number of Fleabanes are widely spread, occurring as weeds in meadows and waste places. They are annuals and not particularly dangerous. Any method of cultivation which prevents them from going to seed will eradicate them. Their seeds are occasionally found in grass and clover seed, but as a rule they ripen and are blown away before the seed crop is harvested. The seeds of the different species are very much alike and closely resemble the seeds of the Goldenrods. **Daisy Fleabane** (*Erigeron annuus* (L.) Pers.), and **Philadelphia Daisy Fleabane** (*Erigeron Philadelphicus* (L.)), illustrated, occur very frequently in meadows. It has a tall, stout, much-branched stem. Leaves coarsely toothed, the lower ones ovate. Heads in corymbs with flowers white, tinged with purple. **Rough Daisy Fleabane** (*Erigeron ramosus* (Walt.) B.S.P.) is also found in clover fields in all parts of Eastern Canada. The stems are smaller and not so branched as with the preceding species, while the heads are smaller and the rays longer. Leaves without teeth or divisions. **Common Fleabane, Horse-weed or Fireweed** (*Erigeron canadensis* L.) is general in fields and waste places. It is most abundant in moist grounds and pastures, but is found in meadow land and even cultivated fields. It is sometimes tall and much branched, with wand-like stems; generally bristly hairy. Leaves without teeth or divisions, linear, the basal ones dentate. The numerous small white flower heads form a panicle. Fleabanes will not become troublesome under a short rotation of crops with clover and a hoed crop or bare fallow. Waste places should be watched and the weeds cut before they develop seed.



Poverty Weed (*Iva axillaris* Pursh.) is a native perennial occurring in grain fields and pastures from Manitoba to the interior of British Columbia, thriving in all soils but generally found on land where there is some alkali. The whole plant has a rank odour. Stems herbaceous, branching, nearly erect, from tough, woody extensive rootstocks 6 to 12 inches high, very leafy. Leaves thick, rough-hairy; the lower ones opposite, the upper alternate. Flower heads drooping, solitary, on short footstalks from the axils of the upper leaves, $\frac{1}{8}$ of an inch across, inconspicuous. The seed is $\frac{1}{8}$ of an inch long; colour variable, olive green, yellowish brown to almost black; surface mealy and dull; pear-shaped, slightly flattened. There are seldom more than one or two seeds in each flower head and many heads have none.



Eradication.—Poverty weed propagates mainly by its underground stems, which send up many flowering leafy shoots, and it is difficult to eradicate when it becomes well established in the rich soils of Western Canada. See under "Perennials," page 15.

False Ragweed (*Iva xanthifolia* Nutt.). A coarse annual growing from 1 to 6 feet in height. It resembles a Giant Ragweed but has the leaves less divided while the seeds are small and pear-shaped, slightly flattened and black, clustered together in small heads. The weed is most frequently met with around barn-yards.

Ragweeds (*Ambrosia* species). **Great Ragweed** (*Ambrosia trifida* L.) is a native annual which occurs occasionally in the eastern provinces and is abundant in the Red River Valley in Manitoba, extending westward mostly along the railways. It is a tall, coarse, branching plant, 4 to 8 feet high with rough stems and leaves. Leaves variable in shape; on young plants they are deeply indented but scarcely lobed, but as the stems grow, 3 or even 5 lobed leaves are produced, but on many plants leaves may be found without lobes. The male and female flowers are borne in different heads on the same plant; the male in long slender spikes at the ends of the branches, and the female two to three together, stalkless in the axils of the leaves at the base of the spikes. Male flowers $\frac{1}{4}$ -inch across, cup-shaped, nodding; stamens yellow and conspicuous. Female flowers inconspicuous; pistils slender and purplish. The seed is about $\frac{1}{4}$ of an inch long, brown, urn-shaped, tipped with a tapering beak and bearing around the base of this, about one-third from the top, 6 or 8 blunt spines, like the points of a crown, which are the ends of more or less distinct ribs. Wheat from some districts in the Prairie Provinces often contains considerable quantities of Great Ragweed seed.



Eradication.—Summer-fallow, followed by spring cultivation. Mow edges, fields and roadways.

Common Ragweed (*Ambrosia artemisiifolia* L.) is the most widely distributed member of this group, being especially abundant in Southwestern Ontario.



It is a native annual, a coarse, branching plant with hairy stems 2 to 4 feet high. Leaves thin, smooth above, greyish white beneath from short, downy hairs, much cut up, pinnatifid, twice divided. The flowers closely resemble those of Great Ragweed but are smaller. The seed is from $\frac{1}{12}$ to $\frac{1}{6}$ of an inch long, dull light straw to dark brown, somewhat pear-shaped, the apex long and tapering to a sharp point. The surface is veined and slightly ridged lengthwise. This ridge usually terminates in sharp teeth, which form a circle around and point toward the apex. These teeth vary in number, size and regularity and are sometimes entirely absent. The outer covering of the seed is brittle and may be more or



less broken away, thus revealing a smooth, brown inner cover. The breaking off of this second coat shows the inside seed, which is greenish white, nearly round and slightly pointed at the base. Ragweed is a common impurity in red clover.

Eradication.—Avoid impure seed. Plough or disk stubble land immediately after harvest or mow to prevent seeding. Short rotation of crops.

Perennial Ragweed (*Ambrosia psilostachya* D.C.) resembles common Ragweed in the shape of the leaves and flowers, but has running rootstocks which throw up weak stems. It occurs on the prairies occasionally.

Cockleburs or Clotburs (*Xanthium* species) are tall, much-branched annuals differing mostly in the character of their fruits or seeds. The leaves are heart-shaped or ovate, except in the **Spring Clotbur** (*Xanthium spinosum* L.) which has lance-shaped or ovate-lance-shaped leaves, tapering at both ends. Some species are abundant as weeds in river bottoms and moist soils throughout the Prairie Provinces and are particularly troublesome to stockmen in parts of Alberta. Other species are plentiful in the eastern provinces, and are frequently reported as a nuisance in sheep pastures. The burs are from 1 to $1\frac{1}{2}$ inches long, hard and leathery, armed with beaks (except in Spring Clotbur) and covered with more or less long, thick, hairy, recurved and crowded prickles. Each bur contains two oblong, flat seeds which retain their vitality for several years. Owing to their large size, the fruits do not occur in crop seeds, but they are distributed to quite a large extent by animals.



Eradication.—These coarse, annual weeds should be watched and, where practicable, hand-pulled from year to year to prevent seeding.

Cone Flower or Black-eyed Susan (*Rudbeckia hirta* L.) is a native biennial occurring in prairie and pasture lands, old meadows and occasionally in cultivated fields. Abundant in Quebec, where it has doubtless been introduced from Western Canada. The plant is coarse, rough-hairy throughout. Stem simple, sometimes branched below. Leaves thick, without teeth or divisions, the upper ones oblong-lance-shaped, stalkless, the lower ones broader at the top, tapering towards the base, on footstalks. The mode of flowering is by showy, terminal, usually solitary heads, glaring golden orange, about the size of those of Ox-eye Daisy. Rays 10 to 20, much longer than the hairy scaly bracts around the flower head.



The dark brown centre, with its chaffy scales hairy at the top, is high, cone-shaped, and often becomes column-shaped in fruit. The seed is about $\frac{1}{12}$ of an inch long, black, 4-angled, narrow, with parallel sides; each side with fine, parallel longitudinal lines. The top of the seed is flat and bears no pappus. The seeds seldom occur in commercial samples. Cone Flower is objectionable in pastures to all kinds of live stock except sheep, which eat it and will do considerable to keep it in check when their pasture is short. When prevalent in meadows it materially reduces the yield and lowers the quality of the hay. Continued cutting for a few years, to prevent the plant from seeding, will suppress it.

Black-headed Sunflower (*Helianthus scaberrimus* Ell.) and **Many-flowered Prairie Sunflower** (*Helianthus Maximiliani* Schrad.) are common

though not very serious weeds in the Prairie Provinces. Their bright yellow flowers are conspicuous in grain fields. The stems are stout, simple or sparingly branched, rough or hairy; leaves thick, ridged and rough. In the former species the heads are nearly solitary and the disc inside the bright rays is dark. With the latter the disc is yellow. The seeds are about one-sixth of an inch long, brown, variable in shape but mostly narrowly oblong, egg-shaped in outline, flattened and rather angular, grooved lengthwise, cross-mottled with irregular zigzag,



white lines; both scars at the top and the base, are conspicuous, the latter rather oblique. They are often abundant in screenings of western grain and frequently occur in seed grain, especially wheat.

Eradication.—Wild Sunflowers are best dealt with by a summer-fallow ploughed early and thoroughly worked throughout the season. **Wild Artichoke** (*Helianthus doronicoides* Lam.), closely allied to the two preceding species, is not so abundant but more difficult to eradicate.

Stinking Mayweed (*Anthemis Cotula* L.) is an annual or winter annual, introduced from Europe. A common weed in old settlements, around buildings,



along roads and in waste places, from the Atlantic coast to Manitoba, where it is rare as yet and found only along railways, but is rapidly appearing in new districts. It is an objectionable pest in fields and gardens; most abundant where crops have killed out in wet places. The plant is dull green, slightly hairy or hairless, with an acrid taste and a strong, fetid odour. Stems 12 to 18 inches high, much branched from the root up. Leaves finely dissected, twice or thrice pinnatifid. Flower heads numerous, white, yellow-eyed, daisy-like, only about one inch in diameter. The seed is small, about $\frac{1}{16}$ of an inch long, ovate-oblong, or oblong, cut off straight at the upper end, with a small knob in the centre, the smaller end abruptly pointed. The surface roughened with tubercles arranged more or less symmetrically in about



10 longitudinal rows; sometimes, however, the surface is nearly smooth. The seeds are a common impurity in grass and clover seeds. The dust from Mayweed, Ragweed and some other species of this family, produced in threshing, is irritating if not poisonous and the pollen often produces hay fever when the plants are in flower.

Eradication.—Good drainage. Repeated close cutting in waste places.

Yarrow (*Achillea millefolium* L.). Perennial with finely dissected fern-like leaves and flat-topped clusters of white or pinkish flowers.

The seeds are flat, chaff-like; about $\frac{1}{16}$ of an inch long, whitish with a dark centre. They are not uncommon impurities in timothy, particularly in Western Canada.

Eradication.—Hoed crops. Pasture with sheep.

Ox-eye Daisy (*Chrysanthemum Leucanthemum* L. var. *pinnatifidum* Lecoq and Lamotte).—Introduced from Europe. Perennial, shallow-rooted. Stems



numerous, simple or little branched, 1 to 3 feet high. Basal leaves are more or less pinnatifid or coarsely and irregularly toothed; middle and upper-stem-leaves narrowly oblong or somewhat lance-shaped, conspicuously pinnatifid at the base. Flower heads solitary on long, naked footstalks, very handsome, $1\frac{1}{2}$ to 2 inches across; rays 20 to 30, pure white, spreading, two to three-toothed at the apex; centre flowers yellow. A single plant produces from 5,000 to 8,000 seeds. Abundant in old pastures, in meadows and by roadsides from the Atlantic coast to the borders of Manitoba and occasionally along the railways to the Pacific coast. The seed is $\frac{1}{12}$ of an inch long, club-shaped or



elongate-ovate, usually curved, almost straight on one side and convex on the other, the knob-like scar at the top prominent; 10 well-defined white ridges run

the whole length of the seed, meeting at both ends; between these ridges the surface of the seed is black, minutely dotted with white; no pappus. Often found in timothy seed from which it is difficult to separate it.

Eradication.—Shallow ploughing followed by cultivation. Short rotation of crops. Rogue seed crops.

Common Ragwort (*Senecio Jacobaea* L.), introduced from Europe, is perennial from a few shallow, short, thick rootstalks. It is abundant in Pictou and Antigonish counties in Nova Scotia and in parts of Prince Edward Island; also reported from Quebec and some parts of Ontario. Ragwort is the cause of a curious and fatal disease of the liver in cattle. Stem stiff, erect, grooved, 2 to 3 feet high, much branched above. Root-leaves 6 to 8 inches long, stalked; stem-leaves stalkless, embracing the stem; all leaves dark green, deeply twice pinnatifid. Flower heads golden-yellow and very showy; $\frac{3}{4}$ of an inch across; numerous, erect, arranged in flat topped, dense, compound corymbs. The seeds are about $\frac{1}{12}$ of an inch long, creamy white, oblong, excavated at the top, with a small central point, deeply grooved along the sides; those of the



less angled, with short bristles; those of the ray-flowers smooth, much curved and broader; pappus white. They are seldom found in commercial samples.

Eradication.—Rotation of crops. Close cutting pastures.

Lesser or Common Burdock (*Arctium minus* Bernh.), introduced from Europe, is a biennial from a deep, thick tap-root. It occurs in rich land in the older settled provinces; common by roadsides, in waste places and orchards in sod. Root-leaves large heart-shaped, downy beneath, somewhat resembling those of rhubarb, footstalks hollow. Flowering stems much branched, from 3 to 6 feet high. Flowers purple. The seed is about $\frac{1}{4}$ of an inch long, pale brown with dark, transverse, zigzag, depressed marks, oblong-ovoid, cut off abruptly at each end, flattened, with about 5 longitudinal ridges generally somewhat curved; apical scar circular with a central point; pappus when present, consisting of several rows of short bristles, upwardly barbed. The seeds are not spread through commercial seeds to any extent.



Eradication.—Pull young plants. Cut, with spade below crown. Cut and burn mature plants.

Canada Thistle (*Cirsium arvense* (L.) Scop.)—Introduced from Europe. Perennial with deep running rootstalks. Stems erect, 2 to 4 feet high. Leaves variable in shape, maimed and crested, very prickly, in some plants much less than in others. Flower heads numerous, in a large loose corymb at the top of the stems. Flowers variable in colour, ranging from pale purple through shades of pink to white. Some plants bear male flowers only, which form no seeds, other plants female flowers only, which produce many seeds; the flower heads of male plants are nearly globe-shaped, 1 inch across, those of the female plant only about half as large, oblong with short florets. Large patches may be found bearing



only male flowers, showing that all the plants originated from a single seed. It is abundant in Eastern Canada, Manitoba and British Columbia and is spreading rapidly in Saskatchewan and Alberta. The seed is $\frac{1}{8}$ of an inch long, light-brown, elongated oblong, smooth, somewhat flattened and curved, more or less

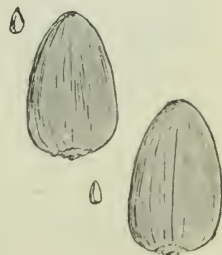
bluntly angled, marked with faint longitudinal lines; the top is nearly round, flat, and has a narrow rim with a small cone-shaped point in the centre. The seeds are frequently found in grass and clover seeds and sometimes in seed grain.

Eradication.—Frequent cultivation to prevent the formation of leaves. Plough in late June or early July and follow by almost weekly cultivation throughout the season. Root crops may be advantageously grown on infested land if kept clean. Small patches should be hoed or dug whenever the plants show above the ground.

Bull or Spear Thistle (*Cirsium lanceolatum* (L.) Hill.) is a large coarse biennial, introduced from Europe, 2 to 4 feet high, widely branching, with many large, deep purple flower heads, $1\frac{1}{4}$ inches high by as much across. The seed is similar to that of Canada Thistle, but larger, about one-sixth of an inch long, plumper in proportion to the length, generally darker at the broader end, greyish brown in colour, marked with faint longitudinal lines. It occurs sometimes in seed grain, but very seldom if ever in clover or grass seed. Bull Thistle does not give trouble in well cultivated fields. It can be eradicated from waste places by cutting below the crown either the first year or before the seeds are ripe the second year. The application of a handful of salt to the root after cutting is effective.



Russian Knapweed (*Centaurea Picris*, D.C.) is a species of Star Thistle the seeds of which occur frequently in samples of Turkestan alfalfa. They are very easily seen among the alfalfa seeds as they are larger and bright white, rarely tinged with yellow at the ends. The seeds are hard, smooth and somewhat shining, with fine vertical lines or ridges which may be distinguished with an ordinary magnifying glass. The notch at the end of the seed, which is so characteristic of most of the Star Thistles, is wanting in this species. The seed is about $\frac{1}{8}$ of an inch long and half as wide, very nearly the same size and shape as that of Bull Thistle but curved evenly on both sides, while the Bull Thistle seed is a little longer and straighter in outline on one side with a deeper curve on the other. This Star Thistle seed is very white in appearance, whereas the Bull Thistle seed is grey or yellowish

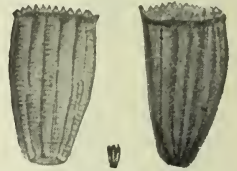


brown with darker lines and a yellow band around the top, forming a little well from the centre of which projects a short rounded knob. The *Centaurea Picris* is the only pure white seed found in commercial samples. This annual weed readily succumbs to ordinary cultivation with rotation of crops.

Chicory (*Cichorium Intybus* L.)—Introduced from Europe. Perennial from a deep, long, thick root. Stem 2 to 3 feet high, branched, hairy below.



Root-leaves closely resembling those of Common Dandelion, 6 to 8 inches long, spreading on the ground. Flower heads bright blue, sometimes purple or nearly white, about two inches across composed entirely of strap-shaped flowers, usually closing by noon, in stalkless clusters of three or four together along the almost leafless stems. It occurs in Eastern Canada, most abundant in Quebec. A common roadside weed and occasionally found in cultivated fields. The seed is $\frac{1}{8}$ inch long, dark brown or straw-coloured, mottled with brown, wedge-shaped, obtusely 3 to 5-angled, sometimes much curved; the surface grooved and ridged from top to bottom and



roughened crosswise with minute, close raised and waved lines; at the top, surrounding the apical scar, is a fringe of short, flat, white bristles. The seeds are often found among crop seeds, particularly in clovers and grasses.

Eradication.—Chicory is not often seen in good farming districts except as a wayside weed. A short rotation of crops will soon suppress it.

Fall Dandelion or August Flower (*Leontodon autumnnalis* L.) is a perennial introduced from Europe. Abundant in the Maritime Provinces and parts



of Quebec and recently reported from several places in Ontario, as occurring in hayfields. It spreads rapidly from seeds, which are spread widely by the wind, and overruns meadows, pastures and lawns, where it chokes out the grass. Rootstalk short and thick, frequently divided into several heads, each of which bears a thick tuft of toothed leaves, somewhat resembling those of Common Dandelion, and several few-flowered, branched, leafless, scaly stems. Flower heads over 1 inch across, bright yellow. The seed is $\frac{1}{4}$ -inch long, brown, linear, not beaked, ribbed lengthwise,



marked with fine lines crosswise, pappus dirty white, in one row of feathery bristles, about the length of the seed itself. The seeds are mostly scattered by the wind before the crops are harvested and seldom occur in commercial seeds.

Eradication.—Fields infested with this weed should be brought under cultivation with a short rotation, such as cereal grain, clover and grass for two years and hoed crops or peas for the fourth year, followed again by cereals.

Common Dandelion (*Taraxacum officinale* Weber) is a well known pest in all long-settled districts. It is very common in lawns and almost impossible to eradicate when thoroughly established. It differs from Fall Dandelion in having long, deep, tapering roots, every part of which, if broken off, will throw out leaves and form new plants, as well as in having hollow, single-headed flower stalks. The seed is about $\frac{1}{8}$ of an inch long, spindle-shaped, ridged lengthwise the ridges roughened with upwardly directed rigid spines decreasing in size from the top to the base of the seed, where they appear as minute tubercles. The top end of the seed runs into a beak, about one-third of an inch



long, crowned with a white, thin papus, half the length of the beak. This beak breaks off easily and is not present on seeds found in commercial samples.

Red-seeded Dandelion (*Taraxacum erythrospermum* Andr.) occurs with the preceding and differs from it merely by having more deeply divided

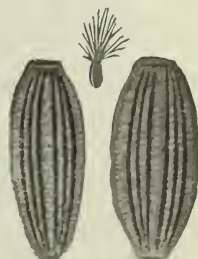
leaves, sulphur-yellow, smaller heads of flowers, and reddish purple seeds.



Eradication.—It is important to prevent dandelions from seeding in lands adjacent to lawns. Though entailing much labour the most satisfactory way to deal with them, when deeply rooted in lawns, is to loosen the soil with a digging fork and pull them up. Thorough and repeated spraying with sulphate of iron is recommended for lawns where this pest is prevalent.

Perennial or Field Sow Thistle (*Sonchus arvensis* L.). Abundant in cultivated fields and along roadsides, rapidly spreading from the Atlantic coast westward and already a serious pest in Manitoba. It is a deep-rooted perennial, with large and vigorous running rootstocks. Stems 1 to 5 feet high, hollow, simple, with few leaves, and branching at the top.

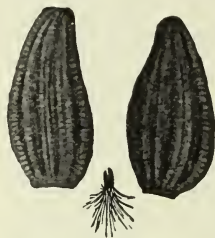
Whole plant filled with a bitter, milky juice. Leaves 6 to 12 inches long, pointed, deeply cut, the lower divisions directed backward, clasping the stem by their heart-shaped base, and edged with soft spines. Flowers bright yellow, $1\frac{1}{2}$ inch across, in corymbs, closing in strong sunlight. The seed is about $\frac{1}{8}$ of an inch long, dark, reddish brown, oblong, closely and deeply ridged lengthwise, the ribs wrinkled transversely, giving



the seed the appearance of being ridged both ways, bearing at the top a tuft of white, silky and persistent hairs which spread in drying and enable the seed to be carried long distances by the wind.

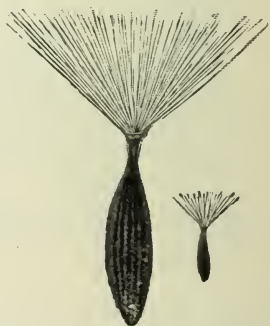
Eradication.—See "Perennials", page 14. Dig out or smother small patches as soon as discovered.

Annual or Common Sow Thistle (*Sonchus oleraceus* L.) has about the same distribution as the Perennial Sow Thistle. Stem, 1 to 4 feet high. Leaves deeply cut and toothed with soft spiny teeth; the basal one pinnatifid, terminated by a large lobe, clasping the stem by their heart-shaped base, ending in sharp points. The flower is pale yellow, about $\frac{1}{2}$ to 1 inch in diameter. The seed is somewhat similar to that of Perennial Sow Thistle but a little shorter, flattened, pointed at



the basal end. The longitudinal ridges are wider apart, much finer, and the whole surface of the seed, the ridges as well as the interspaces, is finely wrinkled transversely. Pappus falls off easily. **Spiny-leaved or Prickly Sow Thistle** (*Sonchus asper* (L.) Hill.) is an annual of the same habit as Common Sow Thistle. It may be easily identified by its more prickly nature and less deeply cut leaves, the base appendages of which, instead of spreading, are appressed to the stem and rounded. The seed is similar to that of the preceding species in size and shape; distinctly 3-nerved on each side but with nerves and interspaces quite smooth. Both of these annuals are comparatively harmless weeds and easily controlled.

Blue Lettuce (*Lactuca pulchella* (Pursh.) DC.), is a native deep-rooted perennial, occurring throughout the Prairie Provinces and British Columbia in moist or sandy soil. It is a troublesome weed, having all the bad characteristics of Prickly Lettuce and much more difficult to suppress. Stems 2 to 3 feet, leafy below. Whole plant smooth and covered with a fine bloom, filled with milky juice. Leaves variable, linear-shaped or oblong; without teeth or divisions, or sometimes dentate or pinnatifid, the divisions directed backward; stem leaves less divided and stalkless. The flower heads are nearly one inch across, pale blue, not very numerous, on scaly footstalks, in a narrow panicle. The seed is about $\frac{1}{4}$ inch long, including the short, thick beak, the tip of which is whitish expanded into a short, cup-shaped disc, red when im-



mature, slatey-grey to purplish when ripe; club-shaped, flattened with thick ridges down each face; whole surface dull and rough; pappus longer than the seed, pure white and silky. The distribution of the seeds should be prevented as far as possible by keeping the plants cut in waste places.

Eradication.—Ploughing in late June, followed by cultivation, thus preventing leaves forming.

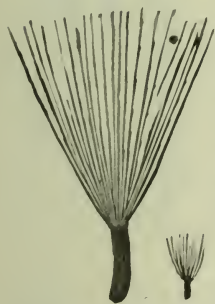
Prickly Lettuce or Compass Plant (*Lactuca scariola* L., and var. *integrata* Gren. & Godr.), introduced from Europe, is annual or occasionally winter annual. It is widely distributed in waste places from Nova Scotia to the Prairie Provinces and reported from parts of British Columbia, sometimes giving trouble in fields. A coarse, tall-stemmed plant, averaging 3 to 5 feet in height. The leaves are oblong-lance-shaped, margined with spines and prickly on the midrib beneath, only the lower ones more or less pinnatifid, stalkless, with ear-like lobes at the base. The leaves of the stem are twisted at the clasping base so as to stand vertically with the edge to the sun, instead of horizontally, as in the case of the leaves of most plants. This peculiarity has given rise to a common name of this lettuce the Compass Plant. The flower heads are pale yellow, less than half an inch across, on a large



wide-spreading panicle, only a few open at a time. The seed is about $\frac{1}{8}$ of an inch long, dark greenish-grey, similar to that of the black-seeded varieties of the garden lettuce, usually a little smaller, and, like them, broadly lance-shaped and somewhat curved, flattened, margined and bearing five to seven narrow ridges down each face; whole surface roughened with fine wrinkles, and short, white bristles on the ridges near the apex.

Eradication.—Clean waste places and seed to grass followed by close cutting of this weed.

Orange Hawkweed or Devil's Paint-brush (*Hieracium aurantiacum*, L.), introduced from Europe, is abundant and troublesome in the upland pastures of the Eastern Townships of Quebec and in some places in New Brunswick and Prince Edward Island; reported occasionally from Ontario and all the eastern provinces. It is a vigorous grower which spreads rapidly by its runners and seeds and soon overruns land that cannot be ploughed, the abundant and useless foliage displacing grass and ruining meadows and pastures. Perennial, low-growing, throwing out many creeping branches close to the ground. Filled with bitter milky sap. Whole plant very hairy. Flowering stems 1 to 2 feet, erect and simple, almost leafless. The fiery orange red of the flowers is very striking. Leaves long, rounded at the top, gradually narrowing towards the base. The seed is



from $\frac{1}{16}$ to $\frac{1}{12}$ of an inch long, purplish-black, unripe seed deep red; strongly 10-ribbed lengthwise. The seeds are spread by the wind and are seldom if ever found in crop seeds.

Eradication.—Plough shallow after hay crop, and summer-fallow for balance of year. Avoid grass crop until completely exterminated. Rocky pastures may be improved by sowing of more vigorous grasses as brome grass.

King Devil (*Hieracium praealtum* Gochnat var. *decipiens* Koch.), introduced from Europe, is another Hawkweed which occurs in the eastern provinces and is abundant in Southwestern New Brunswick, where it is a pest in pasture lands and old meadows. It is a pernicious weed in pastures, being perennial, with the general characteristics of the hawkweeds. It bears a few leaves, nearly all at the base, and numerous slender leafy branches running on the surface of the ground. The whole plant is sparsely hairy and lightly covered with a fine bloom. Basal leaves narrow, the long flower stalk bristly hairy, supporting a spreading corymb of yellow flowers. The seed is similar to that of the other varieties of hawkweeds, a little smaller, black.

Most of our hawkweeds are of relatively recent introduction and many varieties have not yet been exactly located and described. Their identity may occasionally prove difficult, as there seem to be variations in the characters of some varieties. The seeds of the different varieties are practically indistinguishable. They sometimes occur in grass seeds and are a dangerous impurity.

Eradication.—The method of eradication is the same for all and consists mainly of a short rotation, with seeding down to clover and grass at short intervals.

Ergot on Cereals and Grasses (*Claviceps purpurea* (Fr.) Tul.)—There are often found among grains of rye, rarely among those of wheat, and abundantly among the seeds of some grasses, blackish or purplish solid bodies, commonly called ergot. Fresh specimens are of a waxy or oily consistency, purplish white inside. They are the storage organs or resting stage of a parasitic fungus belonging to the genus *Claviceps*. Ergot grains vary in size and form, according to the species of grain or other grasses on which they develop. Each of these solid bodies is called a sclerotium (plural sclerotia), derived from a Greek word *skleros*, hard or dry, in allusion to their nature. They are a part of the vegetative system, the "spawn" of the fungus, in a resting condition, but capable of growth in the spring under such favourable conditions of warmth and moisture as they get when sown with crop seed, or when lying on the ground at the bases of the stems on which they were formed the previous summer. In the spring small toadstool-like bodies, on violet stalks, with round orange-coloured heads, about the size of

mustard seed, are produced from the sclerotia lying on the ground. These develop enormous numbers of microscopically small spores (organs analogous to the seeds of higher plants), at the time when grasses and grains are in flower. The minute spores, carried by currents of air or by insects, lodge in the flowers of the grasses and grow; in a short time they completely destroy the seed and form from them the horn-like sclerotia. During the summer spores are formed on these horns; at the same time appears a sugary secretion very attractive to insects which carry off on their bodies any of the summer spores to the flower-



ing heads of other grasses and thus spread the infection. Late in the summer the production of spores stops, and the sclerotia or storage organs begin to lay up a kind of starch found only in fungi and known as fungus starch, as well as oils, to serve as food for the growth of the fruiting organs to be sent out the following spring. They then harden up, turn dark purple, and fall to the ground or are carried away with the grain or hay. The sclerotia occur on rye, wheat, barley and wild rice, being especially common on rye, and are also found on timothy and other cultivated and wild grasses. They all contain an alkaloid and other violent poisons. Those produced on cereals are usually broken when found in the grain. Some are used in medicine under the name of ergot of rye. Bread made from flour containing ergot may cause a disease known as ergotism; and animals which feed on grain or hay containing ergot may also be severely poisoned, as is sometimes the case on our western plains. Abortion is one well-known result of cows feeding on ergotized grain. Hay containing much ergot should not be fed. Ergotized grain should be thoroughly screened and the sclerotia destroyed. Seed from an ergotized crop should not be used if any other can be procured.

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" psilostachya.....	65	Euphorbia Esula.....	53	Ranunculus abortivus.....	42
" trifida.....	64	" Helioscopia.....	53	" acris.....	42
Anthemis Cotula.....	67	Galeopsis Tetrahit.....	60	" sceleratus.....	42
Arabis glabra.....	50	Gentiana Amarella.....	56	Raphanus Raphanistrum.....	46
Arctium minus.....	68	Gilia linearis.....	57	Rosa pratensis.....	51
Asclepias syriaca.....	56	Helianthus doronicoides.....	66	Rudbeckia hirta.....	66
Avena fatua.....	29	" Maximiliani.....	66	Rumex acetosella.....	33
Axyris amaranthoides.....	35	" Scaberrimus.....	66	" conglomeratus.....	33
Brassica arvensis.....	46	Hieracium aurantiacum.....	73	" crispus.....	33
" campestris.....	47	" praetium.....	74	" obtusifolius.....	33
" juncea.....	47	Hierochloa odorata.....	29	Salsola Kali.....	37
" nigra.....	47	Hordeum jubatum.....	32	Saponaria Vaccaria.....	41
Bromus secalinus.....	30	Hypericum Ascyron.....	54	Senecio Jacobaea.....	68
Camelina dentata.....	45	" ellipticum.....	54	Setaria glauca.....	28
" microcarpa.....	45	" perforatum.....	54	" viridis.....	28
" sativa.....	44	" punctatum.....	54	Sida spinosa.....	54
Capsella Bursa-pastoris.....	44	Iva axillaris.....	64	Silene antirrhina.....	40
Carex vulpinoidea.....	32	" xanthifolia.....	64	" latifolia.....	40
Centaurea Picris.....	69	Lactuca pulchella.....	72	" noctiflora.....	39
Cerastium.....	38	" scariola.....	73	" dichotoma.....	40
Chenopodium album.....	35	Lappula echinata.....	58	Sisymbrium altissimum.....	47
Chrysanthemum Leucanthemum.....	67	Leontodon autumnalis.....	70	" incisum.....	48, 49
Chichorium intybus.....	70	Lepidium apetalum.....	43	" officinale.....	50
Cicuta maculata.....	55	" campestre.....	43	Solidago canadensis.....	63
Cirsium arvense.....	69	" draba.....	43	" graminifolia.....	63
" lanceolatum.....	69	Linaria vulgaris.....	61	" rugosa.....	63
Claviceps purpurea.....	74	Lithospermum arvense.....	58	" Serotina.....	63
Cleome serrulata.....	50	Lolium temulentum.....	31	Sonchus arvensis.....	71
Conringia orientalis.....	47	Lycynis alba.....	40	" asper.....	72
Convolvulus arvensis.....	56	Lycopsis arvensis.....	59	" oleraceus.....	72
" sepium.....	57	Malva rotundifolia.....	53	Spergularia arvensis.....	37
Cuscuta sp.....	57	Medicago lupulina.....	52	Stachys palustris.....	60
Cyperaceae.....	32	Melilotus alba.....	51	Stellaria graminea.....	38
Cyperus esculentus.....	32	" offinalis.....	51	" media.....	38
Daucus Carota.....	56	Neslia paniculata.....	45	Taraxacum erythrospermum.....	71
Digitaria sanguinalis.....	27	Oenothera biennis.....	54	Taraxacum officinale.....	71
" homifusa.....	27	" pallida.....	55	Thlaspi arvense.....	42
Draba nemorosa.....	42	Panicum capillare.....	28	Verbena hastata.....	59
Dracocephalum parviflorum.....	59	Platago aristata.....	62	Vicia angustifolia.....	52
Echium Vulgare.....	59	" lanceolata.....	61	Xanthium spinosum.....	65
Eleocharis ovata.....	32	" major.....	62		



ECONOMIC AND WEED SEED COLLECTIONS

The Dominion Seed Branch, Ottawa, distributes a seed collection at a nominal price in order to assist farmers, seed merchants, school teachers and others interested in this subject in the identification of seeds.

The set consists of 100 economic and weed seeds put up in glass bottles which are fastened in a heavy cardboard tray. These sets are distributed at \$3 and are primarily intended for schools and institutions.

