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ALFALFA DODDER IN COLORADO

BY

W. W ROBBINS and G. E. EGGINTON

Fig. 1—Dodder on alfalfa

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ALFALFA DODDER IN COLORADO

By W. W. ROBBINS and G. E. EGGINTON

Alfalfa is one of Colorado's leading crops. In acreage it is the third largest crop in the State, being exceeded only by wheat and corn. Fig. 2 shows the distribution of the alfalfa acreage in Colorado in 1917, according to the 1918 Year Book of the State of Colorado. Alfalfa is grown mainly as a hay crop in all sections, but there are a few localities where seed is raised, and in increasing amounts each year. Northeastern Colorado depends largely upon other states for its alfalfa seed supply, and much of this supply comes from Utah, Nebraska, Kansas, New Mexico, and Montana. Large amounts of alfalfa seed are raised in the Arkansas Valley;

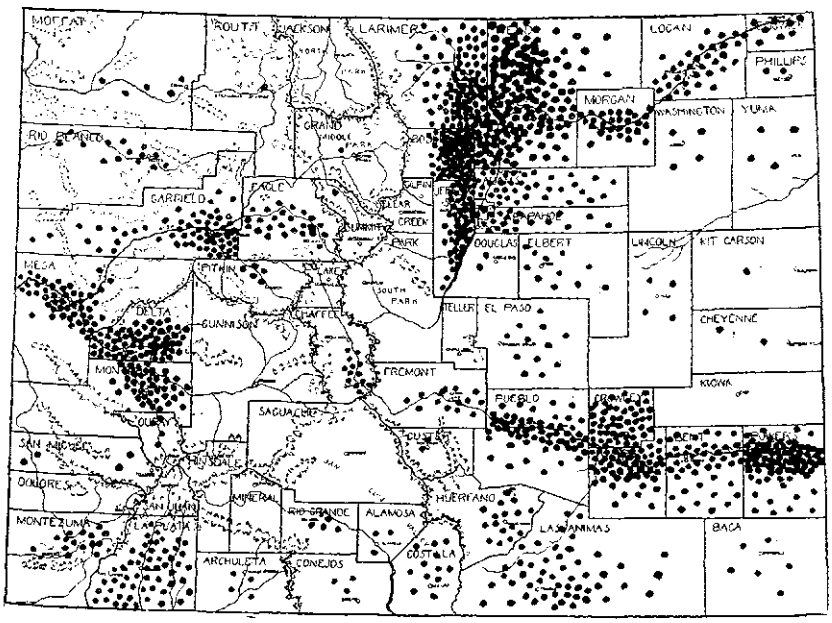

Fig. 2.—Acreage of alfalfa in Colorado in 1917. Each dot equals 500 acres. Total acreage 639,310; total yield 1,804,178 tons. Data from Colorado Year Book, 1918.

in fact, this district is an exporter. Western Colorado also exports seed in excess of that which is retained for local seeding purposes.

One of the worst enemies of alfalfa, both as a hay crop and as a seed crop, is dodder, or "love-vine." Its presence results in a serious reduction of quality and yield. The dodder stems form a dense, yellowish mass on the alfalfa plants, resulting in a dwarfed and weak stand, and stock avoid it when anything else is to be had. Seed from dodder-infested plants requires a longer time to mature, is lighter in weight, and usually shows the result of the great drain on the food supply of the plant.

Alfalfa seed, when mixed with dodder, does not always find a ready market. It is purchased by seedsmen at a much reduced price, and should not be used for seed.

If Colorado communities are to establish a reputation as alfalfa seed producers, it is imperative at the very first that the seed they raise be free from dodder. There is nothing that will keep buyers of alfalfa seed away from a community as much as a knowledge that the alfalfa of that particular district is infested with dodder.

The seriousness of dodder as a pest is widely recognized in Europe, and stringent measures have been instituted to prevent its spread.

In several of the states having seed laws, restrictions are placed upon the sale of agricultural seeds containing dodder, but these measures lack the effectiveness of the European federal control regulations, in that there are always markets for inferior seed in states having no seed legislation. For example, in North Dakota it is unlawful to sell any seed containing dodder, while in Idaho the presence of more than one seed of dodder in 10,000 of agricultural seed offered for sale condemns the lot as unfit for seeding within the state. This condemned seed naturally finds its way to a state without seed legislation or to one whose seed laws do not prevent its sale.

A more widespread knowledge of the seriousness of the dodder pest is necessary in combating its growth in the United States. When the farmer and seedsman realize the dangers and losses which threaten them, greater emphasis will be placed on pure seed and the benefits to be derived from very thoro cleaning before seed is marketed.

The necessity for clean alfalfa seed is evident when it is realized that increased yields both in hay and seed, and additional profit to the grower will result. The initial cost of inferior seed is proportionately greater than pure seed not only because of the impurities present, but because of the damaging effect upon clean

TABLE I
SHOWING PURITY TESTS OF ALFALFA SAMPLES CONTAINING DODDER
Samples from Colorado Submitted to Colorado Seed Laboratory

Pure Seed	Kind of Dodder	No. of Dodder Seeds per lb.	Removable by Milling	No. of Sample
97.9	C. arvensis	180	yes	629
99.1	C. planiflora	180	"	724
99.6	C. arvensis	90	"	634
95.1	C. "	270	"	810
99.1	C. planiflora	180	"	1555
98.1	C. indecora	2475	no	1889
98.4	"	180	"	2213
98.6	"	450	"	2461
92.1	C. planiflora	2070	yes	496
94.2	C. indecora	60	no	432
96.0	C. planiflora	270	yes	2237
96.9	C. indecora	810	no	2858
97.8	C. planiflora	90	yes	517
99.3	C. indecora	90	no	645
99.4	"	180	"	592
98.8	C. arvensis / C. indecora	90 / 810	yes / no	591
92.9	C. indecora	1080	no	590
98.9	C. "	450	"	1121
99.7	"	90	"	663
99.5	"	90	"	527
99.4	"	180	"	690
99.2	C. arvensis	270	yes	190
99.3	"	450	"	1566
99.6	"	180	"	114
99.5	"	180	"	60
98.5	C. planiflora	630	"	1247
97.6	"	990	"	338
97.8	"	90	"	339
58.1	"	2700	"	286

farms. Take, for example, a lot of seed which is 98 percent pure, the remaining 2 percent being weed seeds. Assume that this lot will germinate 100 per cent. Even tho the vitality is perfect, the buyer is paying for 2 pounds of weed seeds in each 100 pounds. At the present market value of alfalfa seed the cost will range from 20 cents to 22 cents per pound for weed seeds.

ALFALFA DODDER IN COLORADO

Dodder has been observed in almost all the alfalfa-growing sections of the State In some it is just making its appearance and may be found in small, isolated patches on farms here and there; in others it is rapidly becoming a serious pest. Some of the alfalfa seed-producing sections are growing seed free from dodder, and are attempting to maintain their reputation for clean seed. On the other hand, there are several localities producing alfalfa seed which is heavily infested with dodder. From August 1, 1917, to July 30, 1918, 29 samples of alfalfa seed carrying dodder were submitted to the Colorado Seed Laboratory for test and analysis. Table I summarizes the purity tests of these samples. The laboratory traced the origin of these dodder-infested samples and found that in Colorado three widely-separated localities were putting on the market seed containing dodder. These communities should organize to eradicate dodder or their reputation as producers

TABLE II
SHOWING THE MILLING POSSIBILITIES OF DODDER-INFESTED SEED
Samples from Colorado Submitted to Colorado Seed Laboratory

Total Number of Alfalfa Samples	No. Containing Dodder	Percent Containing Dodder	No. Capable of Being Milled	Percent of Samples Containing Dodder Capable of Being Milled
403	29	7.5	16	55.1

of alfalfa seed will be injured. Moreover, they exist as centers of infection. In such communities there are, here and there, fields of alfalfa that are entirely clean, but they are in continual danger of being infected from neighboring fields, even tho precautions are taken to use dodder-free seed. Irrigation water is one of the chief agencies in the spread of dodder in a section. Hay, either loose or baled, carrying dodder, may also be a source of contamination.

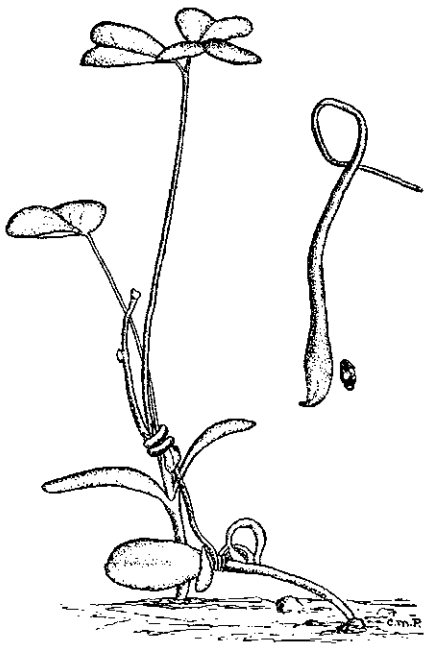

Fig. 3—(Right) Very young dodder plant; (Left) the young dodder plant has attached itself to two alfalfa seedlings, and has lost its connection with the ground

General Appearance of Dodder in the Field.—Dodder plants have slender, thread-like stems of a yellowish or orange color which twine and coil about the alfalfa plants (Figs. 1 and 3). It is extremely difficult to detect the presence of dodder in a stand of young alfalfa plants, as the threads are small and inconspicuous. The dodder seeds germinate about the same time as alfalfa seeds. As the alfalfa plants grow, dodder keeps pace, spreading and branching extensively. Soon the dodder in a field may be detected by the dense growth of yellow, tangled stems, or by the occurrence of patches of stunted alfalfa plants, and in severe cases, by a mat of dodder and alfalfa.

Life History of Dodder Plant.—Dodder is a flowering plant and produces seed. The seeds resemble those of alfalfa to a considerable degree, in fact, it requires more than casual observation to detect the seeds of dodder among seeds of alfalfa. The seeds are produced in tremendous numbers, and fall to the ground or are harvested with the crop. They retain their vitality

for at least five years under ordinary field conditions. Some of the dodder seeds may germinate the same season they mature, while others rest over. The conditions favoring their germination are similar to those which are required for the germination of alfalfa seed.

The dodder seeds germinate in the ground, and the young plant is at first dependent upon food stored within the seed. A slender, yellowish, leafless stem (Fig. 3) is sent out, which swings slowly

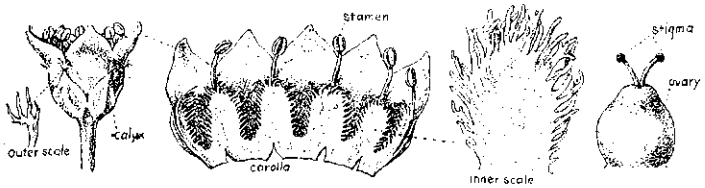

Fig. 4—Flower of large-seeded dodder showing structure (After Longyear)

about in its growth, and if its comes in contact with a suitable support, it coils about it. Very soon small, wart-like suckers (haustoria) appear along the slender dodder stem, and these penetrate the tissues of the plant upon which dodder is preying. Through these suckers the dodder draws nourishment from the alfalfa plant. Having established itself upon its host and derived food from it, dodder loses all connection with the soil by the shriveling up of the lower part of the stem. If the young seedling does not encounter a suitable host, it withers and dies. Thus, dodder is a parasitic, seed-producing plant. This is indeed rather unusual, for we know that practically all seed-producing plants draw nourishment from the soil, and possess green leaves which enable them to make their own food.

As dodder grows older, it branches and re-branches, spreading from plant to plant. The older branches may die if the stems upon which they are fastened are used up, but new branches are continually formed. Any growing section of a dodder plant is independent of another, for it gains its nourishment locally, and is not dependent upon an older part of the stem to conduct its food supply from a remote distance. This habit makes it very difficult to eliminate from a field. After a period of growth, small, white or cream-colored flowers (Figs. 4, 5 and 6) are produced in clusters. Each bell-shaped blossom has the usual parts of a flower, and produces a seed pod which contains two or three seeds. Altho a ma-

jority of the flowers appear simultaneously, there is a succession of these, so that flowers and seeds may be produced thruout a greater part of the growing season. Consequently, a quantity of

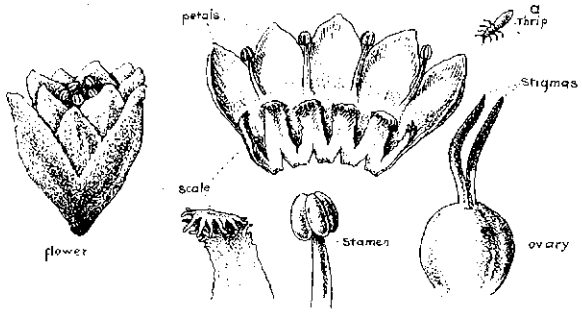

Fig. 5—Flower of small-seeded alfalfa dodder showing structure (After Longyear)

seed-bearing pods is bound to be harvested with the alfalfa seed crop. It is entirely possible to harvest a hay crop before dodder seeds mature.

In some sections of the United States clover dodder has been observed as perennial in habit, the threads hibernating over the winter on the crowns of the host plants. Whether or not alfalfa dodders of Colorado live over from season to season in any other form than seed has not been determined.

How Dodder Is Spread.— In Colorado there are four chief ways of infection by dodder: (1) Impure seed, (2) irrigation water, (3) hay, (4) manure. Undoubtedly, the first is of the greatest importance, but the others must not be disregarded. The rather prevalent practice of planting alfalfa seed without first having a purity analysis, as well as a germination test, made of it, is strongly to be condemned.

There is both dodder-free and dodder-infested seed on the market in our State. Seedsmen now, under the provisions of the Pure Seed Law, are required to label all seed. This law designates dodder as noxious and requires that the label give the name and approximate number per pound of each kind of noxious weed seeds which are present in excess of 90 seeds per pound of such field seeds. This means that a purchaser of alfalfa seed may know, by reading the label attached to the seed he buys, whether or not there are more than 90 dodder seeds to the pound of alfalfa seed. But unfortunately if there are any less than 90 dodder seeds to the pound of alfalfa seed, the label probably will not, at least it need not, show this. Consequently, it is strongly recommended that all alfalfa seed be thoroly tested as to purity before planting, in order to detect the presence of even very slight amounts of dodder

If dodder is present the seed should be thoroly cleaned in a manner hereinafter described, before planting, to remove every last dodder seed.

Altho the sowing of dodder-infested alfalfa seed is the most common means of introducing dodder into fields, the pest is carried from farm to farm under the same ditch and from one part of the field to another by means of irrigation water. This fact points out the need of eradicating the plant just as soon as it is detected, and before seed has been produced. Alfalfa fields will bear frequent and thoro inspection, that the young growth of dodder may be detected.

Baled hay is one of the chief carriers of dodder seed. As the hay is raked in the field and moved to the stack, and out of the field, dodder seed may be scattered.

The seeds of dodder pass uninjured thru the digestive tracts of animals, and consequently, may be spread in manure.

KINDS OF DODDER INFESTING ALFALFA IN COLORADO

There are numerous species of dodder in Colorado, all of which, however, do not attack alfalfa. A number attack native plants. *Cuscuta umbellata,* for example, occurs on plants of the pigweed, purslane, caltrop, four-o-clock, and sunflower families, but is not parasitic on alfalfa or other legumes; *Cuscuta megalocarpa* is parasitic only on willows; whereas, some dodder species, such as *Cuscuta arvensis, Cuscuta planiflora,* and *Cuscuta indecora,* find a congenial home on various herbs. Thus it is seen that some dodder species are limited in their hosts, while others are indifferent.

The species of dodder attacking alfalfa in Colorado, as far as observations to date are concerned, are:

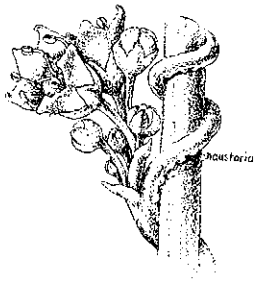

Fig. 6--Flower cluster of large-seeded dodder, enlarged (After Longyear)

1. Small-seeded Alfalfa Dodder (Cuscuta planiflora).—This is the most common and destructive dodder in the alfalfa-growing sections of Colorado. It is parasitic on other plants besides alfalfa.

2. Field Dodder (Cuscuta arvensis).—This infests alfalfa, clover, and many wild herbaceous plants.

3. Large-seeded Dodder (Cuscuta indecora).—This is found thruout the West and infests many different kinds of herbs, but chiefly those belonging to the legume and composite families.

ERADICATION OF DODDER IN THE FIELD WHEN THE AREAS OF INFECTION ARE SMALL

Alfalfa fields should be given frequent and thoro inspection. A new stand should be given particular attention in order that early infestation may be found and promptly looked after. As a rule, in an acreage of alfalfa, dodder appears here and there in patches. Where such patches of limited extent are found, one should cut the infested plants *close to the ground*, beginning at the *outside* of the infested area and working toward the center *so as not to scatter the seeds or pieces of vine* to dodder-free places. *Burn* the plants as soon as they are dry. If the spots are not cut until the seeds are ripened it will be necessary to hoe the cut area to a depth of two or three inches every few days for several weeks, in order to induce germination of dodder seeds and to eradicate seedlings. It is also necessary to carefully watch the alfalfa plants at the edges of the cut area, and destroy any upon which dodder makes its appearance. It is well to remember that when dodder is once established over large areas, its eradication becomes almost an impossibility.

ERADICATION OF DODDER WHEN THE AREAS OF INFECTION ARE LARGE

As has just been indicated, this is a most difficult problem. A badly infested stand of alfalfa may be mowed and used for hay. However, if this is done, the crop should be cut *before* the dodder plants seed. The alfalfa is then plowed under and the area planted to some crop which requires frequent cultivation. If a heavily infested crop of alfalfa is cut *after* dodder has seeded, the use of the hay may lead to greater spreading of the parasite. Moreover, as the hay infested with dodder is raked from one part of the field to another and hauled from the field, the seeds are scattered in a most efficient manner. And, too, dodder seeds may be carried long distances in baled hay. These facts emphasize the seriousness of dodder in alfalfa, and indicate the urgency of using clean seed, or if the plant makes its appearance in the field, of eradicating it while still in isolated patches, or plowing under the infested crop before the parasite seeds.

If seeds have been allowed to mature over an extensive and heavily infested area, it is strongly advisable to mow closely the entire crop, allow it to dry, and burn on the field. Many of the seeds which have dropped to the ground will be killed by the surface heat. The land is then plowed and kept in cultivated crops for a number of years before alfalfa is again planted. It has been

shown that dodder seeds may remain alive for a number of years buried in the soil, the number depending upon the depth of burial and soil conditions.

CLEANING ALFALFA SEED

It is essential that the farmer possess some knowledge of the several dodders in order that he may recognize them when buying alfalfa seed (Fig. 7). The fact that he is familiar with dodder seed will serve to make him more careful in selecting and will help greatly in the elimination of undesirable lots. The importance of clean seed, even tho the initial cost is greater, should not be underestimated. Obtain seed high in purity and free from dodder or other noxious weeds. Seeds of field dodder and small-seeded alfalfa dodder vary greatly in shape and size but are usually much smaller than the average alfalfa seed.

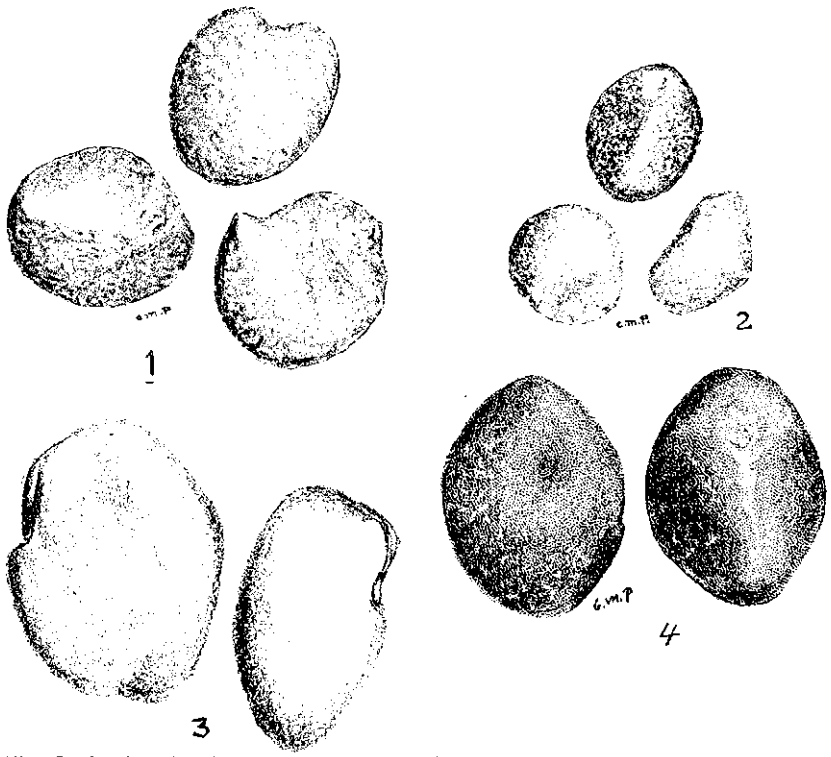

Fig. 7—Seeds of alfalfa and dodder. (1) field dodder; (2) small-seeded alfalfa dodder; (3) alfalfa; (4) large-seeded dodder

Seeds of field dodder are rounded on one side, flattened in one or more planes on the other, dull gray or dull yellow in color and about the size of alsike clover seed. Seeds of small-seeded

alfalfa dodder are oblong in shape, with one side rounded and on the other side usually two flattened planes which form a distinct ridge. The ends of the seeds are flattened at right angles to the end of the ridge. Large-seeded dodder is more difficult to detect than the two dodders above mentioned. This dodder is practically the same size as alfalfa seed, and of the same color, tho dull and rough and often very dark. The seed is disk-shaped, with a slightly rounded face, the other side being concave or variously grooved. In examining alfalfa seed, only an expert can detect dodder seed without the aid of a magnifying glass. The seeds of dodder are always rough and dull, whereas alfalfa seeds are smooth and often shiny (Turkestan alfalfa excepted). In buying alfalfa seed, avoid cheap lots, and when examining a lot before purchase do not be satisfied after carefully going over a handful but examine a large amount, preferably one pound or more.

The recleaning of alfalfa seed by seed companies before offering for sale, or cleaning at home by means of a small hand mill, offer the most promising solutions for the prevention of dodder seed dissemination. Both small-seeded alfalfa dodder and field dodder can be removed from alfalfa by means of power driven mills, hand mills, and hand sieves. No process for the removal of large-seeded alfalfa dodder has been perfected as yet. The largest seed companies in the United States believe that any attempt to remove large-seeded dodder would be unsuccessful. At the present time the separation cannot be accomplished.

Power driven mills are not essential for cleaning seed on the farm or in the small rural community. A good hand mill will serve the purpose for a large acreage, while a hand sieve can be used to advantage if only a few acres are to be sown. Hand mills can be purchased at a reasonable cost from the local seed dealer, hardware merchant or wholesale seed companies.

The capacity of the hand mill varies according to the condition of the seed and the separations necessary. If the alfalfa seed is fairly clean, between two and three bags an hour can be run thru the mill. The revolutions of the crank should not exceed forty per minute, and if good work is to be done, the crank should be turned with a steady motion. Run the alfalfa in a thin stream upon the screen and do not flood the surface, or dodder will be carried over with the clean seed.

The best screens to use depend upon the plumpness of alfalfa seed. Usually a 1-12 or 1-14 perforated zinc top screen, a 1-20 or 1-22 middle screen and a 6x24 or 6x38 bottom screen form a combination which will give the best results. These screens, when prop-

erly used, will remove both field dodder and small-seeded alfalfa dodder. The use of rectangular mesh sieves advocated for bottom screens should be discouraged for top screens, as there is a tendency for the mesh to spread and become irregular with constant use and the forcing of seed thru it.

Hand sieves can be made at home or ordered from the local tinsmith. To remove dodder (field and small-seeded) use a 20x22 brass [1]mesh screen either 32 or 34 gauge, stretched over a sawed-off cheese box or square box (Fig. 8). The screen can be held in position by using hoop lath when the screen is constructed with a round container or straight lath if a box is used.

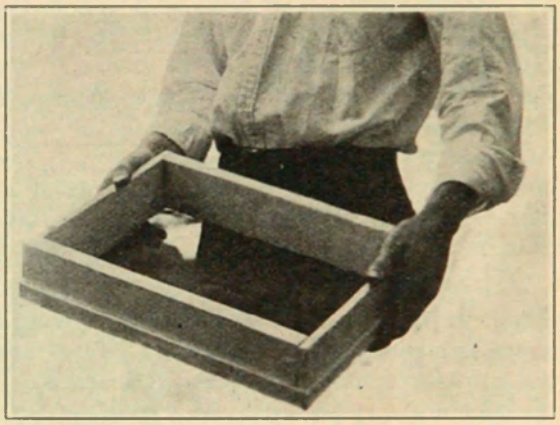

Fig. 8—Hand sieve, 20x22 brass mesh screen, either 32 or 34 gauge, for removing field and small-seeded dodder from alfalfa

In using a hand screen, it is advisable not to have the seed more than half an inch deep while sifting. To properly sift any kind of seed, use a rotary motion, reversing the direction every ten seconds, then strike the bottom of the sieve against a stationary body in order to shake loose any particles that have become wedged in the screen.

[1] Brass mesh can be purchased thru the local tinsmith or hardware store at about 50 cents per square foot.

SUMMARY

Alfalfa is one of Colorado's leading crops. The acreage in 1917 was 639,310 acres, with a yield of 1,804,178 tons.

Alfalfa in Colorado is raised mainly as a hay crop, but large quantities of seed are also annually produced.

Dodder, or "love-vine," is one of the worst enemies of alfalfa in the State, reducing the yield of hay and contaminating the seed crop.

In many European countries, one seed of dodder in a sample is sufficient to condemn the entire lot. This regulation is not too stringent.

Dodder has been observed in all the alfalfa-growing sections of Colorado, in a greater or lesser degree.

The origin of dodder-infested alfalfa seed from Colorado has been traced to three widely separated localities. These communities should organize to eradicate dodder.

Dodder plants have slender, thread-like stems of a yellowish or orange color which twine and coil about the alfalfa plants.

Dodder is a parasitic flowering plant and produces seed.

The seeds of dodder resemble those of alfalfa.

Dodder seeds germinate in the ground, but as soon as the parasite has become attached to alfalfa and is getting nourishment from its tissues, it loses connection with the ground.

Dodder is spread in (1) impure seed, (2) irrigation water, (3) hay, and (4) manure.

A purity analysis should be made of all alfalfa seed before planting.

The species of dodder attacking alfalfa in Colorado are: (1) Small-seeded alfalfa dodder (*Cuscuta planiflora*), (2) field dodder (*Cuscuta arvensis*), and (3) large-seeded dodder (*Cuscuta indecora*).

When areas of infection by dodder are small, the infested plants should be cut close to the ground, beginning at the outside of the area and working toward the center. Burn the plants when dry. Hoe the cut area to a depth of two or three inches every few days for several weeks.

When areas of infection by dodder are extensive, it may be mowed and used for hay if cut before the dodder plants seed. Then plow the area and plant to cultivated crop. If seeds have been allowed to mature over an extensive and heavily infested area, mow entire crop closely, allow to dry and burn. Then plow the

land and keep in cultivated crops for several seasons.

Field dodder and small-seeded alfalfa dodder can be removed from alfalfa seed by means of power driven mills, hand mills, and hand sieves.

Use only cleaned and dodder-free alfalfa seed of high germinating capacity.


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