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(The author of each article in SPUD NOTES is responsible for recommendations and statements made therein.)

POTATO CULTIVATION WITH SWEEPS (DUCKFEET)

Nelson E. Reynold*

About 60 years ago Dowden invented the potato digger. He elevated the potatoes up over a high "hill" -- probably only because he played "anti-over" as a boy. Now the level-bed digger is used because it does not bruise the potatoes. Likewise, in the past farmers have cultivated potatoes with the hilling type shovels and spend much time getting a perfect ridge only to harrow it down immediately--just because Grandpop did it that way.

Potato growers have spent countless hours adjusting shovels perfectly. Too often the many adjustments on farm machines are "only a means of getting them out of adjustment" and sometimes are more trouble than they are worth. Why were these twisted, hilling-type shovels ever invented? They mulch the soil in the ditch areas but not in the root-growth areas, and they do not loosen the compacted earth in the centers of the rows so the tender roots can expand as they should. Mulching the soil in the row-centers is far more important than in the ditches and is much easier. Every spring farmers "wade" through miles of soft ditches, cultivating these ditches but not the newly planted potatoes.

It is well to analyze the present method of potato cultivation. The following thoughts are worthy of consideration:

1. Why strive to produce a perfect ridge and then harrow it down in a few hours?
2. Hilling shovels bring a great deal of moist earth (and slickers) to the surface and this moisture might be valuable in giving the newly planted seed the necessary start.
3. Too few or poorly spaced hilling shovels make subsurface troughs in the ditches, and if these grooves are not cultivated out later they make traps that retard the flow of irrigation water toward the seed pieces.
4. In heavy soils especially, the new seed will be left up on a compacted subsurface mound which the roots cannot penetrate. These tiny roots follow the easiest channels in the mulched ground near the surface and go out 6 inches to 8 inches before turning downward in the loose soil in the ditches.
5. Planter shoes often press the heavier soils so tightly that the roots never penetrate this groove and the hilling shovels do not crack this solid earth.
6. The roots, stolons, and potatoes should expand near the row centers and not out in the ditches or too near the soil surface.

The problem is that of providing a simple method of mulching the soil in the root-growing areas so as to produce a strong and healthy root system at the EARLIEST possible time. Of course, much depends on soil type, elapsed time since plowing, precipitation, and field preparation. Several types of tools have been used, but the best results were obtained with common ten inch sweeps or duckfeet. Therefore what is suggested here is a deep tillage program of "under-cutting" the newly planted seed. Sweeps should go 2 inches to 5 inches under the seed pieces; an

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average of 2 inches to 3 inches will give good results. Depth will vary according to planting depth, soil condition, and tractor power.

In cultivating two rows there should be four sweeps in front and they should be placed 7 inches from the row-center or straddle the rows 14 inches apart. All four sweeps should run at the same depth and if possible should be on rigid, strong cross bars. With this setting of the 10 inch sweeps there will be a gap of 4 inches between the tips of the sweeps (directly under the seed) but the ground will be cracked thoroughly under the row center. Three 10 inch sweeps are used in the ditch centers, these sweeps being set with slight suck, whereas the front four are set practically flat. By setting the three rear sweeps a little shallower than the front ones on the first cultivation a subsurface trough will be formed to direct the rain or irrigation water toward the row and subirrigate the seed. These sweeps with this setting can be used on rows planted 34 inches or 36 inches apart though it might be advisable to use 12 inch sweeps in wider spacings. When recently plowed alfalfa ground is being cultivated, the tools should be staggered as much as possible to prevent clogging; this trouble is always difficult to eliminate entirely if the roots are thick and tough.

A very important fact should be noted. The top surface of the field is left much as the surface of fields that have been ridged up and harrowed down. However, it will be smoother and free from clods and broken "slickers." This means a better mulch of dry top soil and the elimination of the harrowing operation entirely. Also the small weeds that were not killed by the planter disks will be uprooted completely.

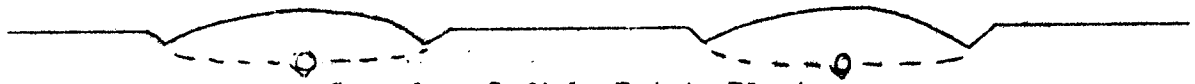
The second cultivation is also important. The same four front sweeps can be used, and ditchers for hilling can be placed in the ditch centers in the rear. Since this cultivation is generally done when the plants are from 4 inches to 8 inches high, the operator should determine carefully how far the roots extend toward the ditches. The front sweeps should be set out so as not to cut the roots. Since these conditions vary greatly, the tools normally should be set at 9 inches to 11 inches from the row centers or 18 inches to 22 inches apart. Sweeps will damage the root system less than hilling shovels, hull tongues, or spearhead shovels but must be spaced properly. The ditchers can be set in the ditch centers so as to hill up the rows and cover the weeds around the plants as required.

Most of the fields that were cultivated with sweeps in 1942 were either hailed badly or damaged by late blight so that no general production comparisons were obtainable. One grower with large acreage had 80 acres cultivated by sweeps and about 100 acres by the old tooling equipment. Examination of the root areas was very interesting and favorable to the sweep method, the plants being much stronger throughout the entire season. The field cultivated with sweeps made about 25 sacks per acre more than the field cultivated with shovels.

The following sketches may be of some value to any who may contemplate using the sweep method of potato cultivation.

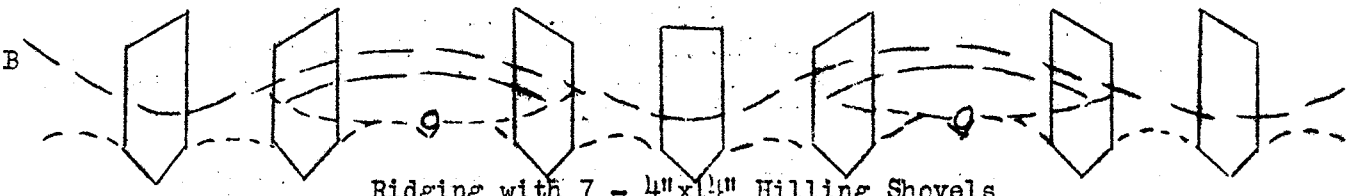
CULTIVATION OF POTATOES

A



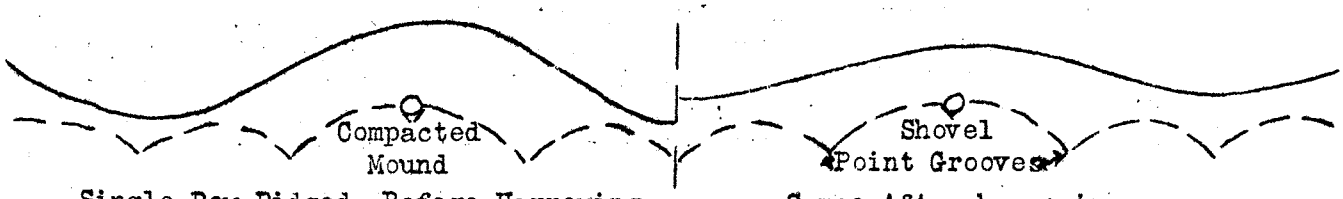
Ground as Left by Potato Planter

B



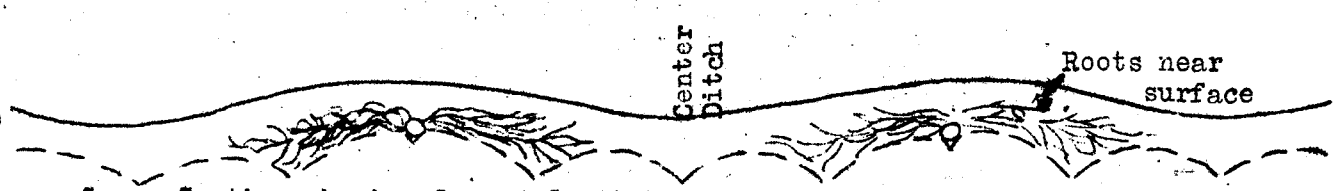
Ridging with 7 - 4"x14" Hilling Shovels

C



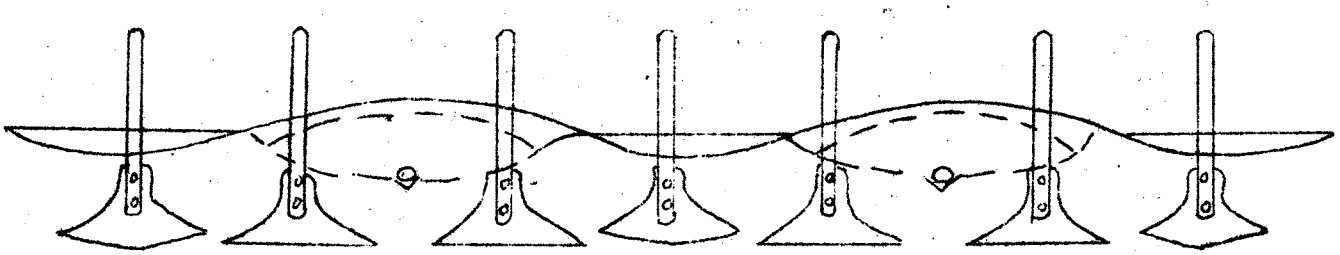
Single Row Ridged--Before Harrowing Same: After harrowing

D



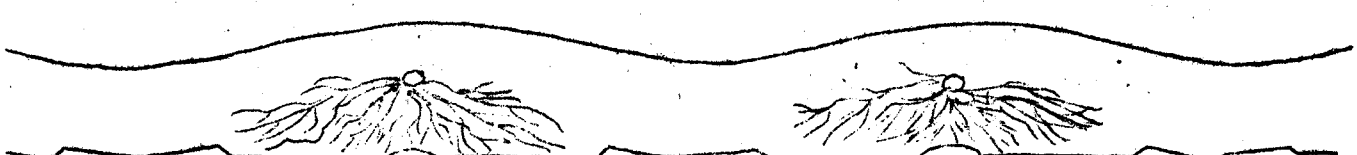
Cross Section showing Ground Condition After Harrowing. Note Root System in Mulched Soil and Shovel Groove

E



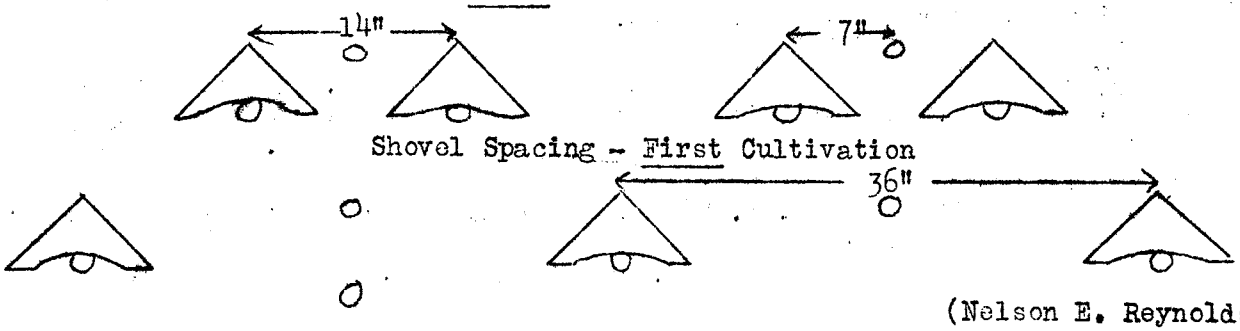
Under Cutting Seed Pieces with 10" Sweeps

F



Results of Deep Tillage with Sweeps - Soil Entirely Mulched. Note Root system Under Seed Pieces

G



Shovel Spacing - First Cultivation

(Nelson E. Reynolds)

POTATO STORAGE STUDY AT THE SAN LUIS VALLEY EXPERIMENTAL AND DEMONSTRATION FARM

by Alfred D. Edgar*

The cooperative potato storage project carried on at the Center Experimental and Demonstration Farm in the San Luis Valley was an important part of the experimental storage work for the 1942-43 season. Mr. Frank McGee of the Colorado State College Extension Service and Mr. Alfred Kramer of the Farm worked with the writer in every phase of the work. Mr. Kramer made periodic readings of thermocouples, placed in bins during the storage season.

The potato storage at the Farm is an adobe-walled and earth-roofed storage, of a type common in the Valley: The 30-inch walls are made up of two 12 inch adobe walls and an air space; the roof and ceiling are of poles covered with 6 inches of willow brush and straw, overlaid with about 6 inches of earth; the slope over the bins is about 2 inches per foot, and over the center the earth is mounded over flat supporting poles; there is a 2 inch air circulation space, tightly boarded against the potatoes, at the outer wall; and for ventilation the south door is used as an intake and one large roof ventilator near the north end is used as an outtake.

We first planned to ventilate until all potatoes in the bins were within a temperature range of 36° to 40° F., then to heat or ventilate as required to maintain that temperature. This was based upon previous work in storages with well-insulated ceilings. However, on January 9 the temperature range in the bins was found to be from 35° to 43° F. Therefore we decided not to lower the maximum temperature to 40° for fear of freezing potatoes at the minimum point. This 8° temperature range indicated the need of better ceiling insulation. Also the top potatoes in the bins in some cases, were 7° colder than those in the bin centers. This temperature difference sometimes resulted in moisture condensing on the top potatoes.

Storage studies were carried on in three experimental bins, each 8 feet by 14 feet in plan; the potatoes were stored 7 feet deep at walls and 9 feet deep adjoining the central 10 foot work and drive alley; bin walls and partitions were tightly boarded, and on the bulk bins the bin fronts were tight plank. All bins were filled between September 22 and October 4, 1942, and all were graded out between March 15 and 20, 1943, an average storage period of 180 days. By using night ventilation the potatoes were cooled to an average of 40° F. by January 1 and the humidity was kept above 85 percent, except for short periods when the doors were open; potato shrinkage was between 2 and 3 percent of the weight of potatoes placed in storage.

Bin 2E was filled with potatoes picked and stored field-run in smooth boxes holding 50 pounds each. This bin had a slatted board floor, and potatoes were stacked to as near ceiling as possible. Only 18,700 pounds of boxed potatoes could be stored in the bin; this was only 60 percent of its bulk capacity.

Bin 6E was filled with 32,400 pounds of bulk potatoes, stored field-run. This bin had a board floor over a 4 inch air circulation space, which connected alley air with the wall air circulation space.

Bin 6W was filled with 30,300 pounds of bulk potatoes, stored field-run on an earth floor. A triangular wall-floor flue connected alley air with the wall air circulation space.

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*Agricultural Engineer, U. S. Department of Agriculture, in cooperation with the Colorado Agricultural Experiment Station.

Thermocouple temperature observations taken at 15 points in each bin showed that the potato temperature in bin 6E averaged 1.6° F. lower through October and November than in bin 6W. However, during the winter months when ventilation was discontinued the cold point in bin 6W was lower than that in bin 6E. Thus floor circulation in 6E was more effective than the earth floor in 6W in cooling the bins when cold air circulation was used and for keeping uniform storage temperatures when ventilation was discontinued. The board floor is also desirable when storing sacked potatoes.

While potatoes from bins 6E and 6W were similar in quality when removed from storage, those from the boxes in bin 2E were of much higher quality than from either of the other bins. Thousand pound samples on potatoes above 1-7/8 inches in size were graded for quality from bins 2E and 6E; 41.9 percent were of a very select grade from bin 2E compared with but 12.4 percent of the select grade from bin 6E. All of the potatoes from bin 2E were then run over a 2-1/2 inch screen and 46.3 percent of them graded U.S. No. 1 Extra Fancy--93 percent being over 2-3/4 inches size. The cost of box storage based on 60 percent of bulk capacity and box costs of 6¢ per cwt. per year runs at about 19¢ per cwt. for box storage compared with 8¢ per cwt. per year for bulk storage. This year box storage did not pay the extra storage costs, for although there were 29.5 percent more extra fancy potatoes in the boxes than from bulk storage, all were sold at the ceiling prices for U.S. No. 1's and seed potatoes.

THE SCAB AND RHIZOCTONIA DISEASES OF POTATOES

L. A. Schaal*

Common scab and the Rhizoctonia disease of potatoes continue to be a major problem in the production of high-quality potatoes in Colorado. Neither of these diseases commonly cause serious reductions in yield of potatoes in the State, but they do lower the yield of marketable tubers.

The common-scab organism lives in the soil and on scab-infected tubers. The scab organism can live in the soil independent of the potato, and thus clean seed planted in scab-infested soil may produce scabby tubers. On the other hand scabby, untreated seed may produce a clean crop. If the physical and chemical conditions of the soil are not favorable for the scab organism, even though scabby seed is planted, no infection results. It is safest, however, to treat all scabby seed since the organism may be introduced by infected seed into otherwise clean soil. Attempts have been made to kill the scab organism in the soil by adding chemicals to fertilizer or by applying it directly to the soil at planting time. No scab control has been obtained in this fashion in Colorado soils. Sulfur applied to the soil apparently does not produce beneficial results. The highly alkaline soils of Colorado make the acidification of soil impractical. The scab organism will not live in strongly acid soils but the amount of sulfur required to acidify the strongly alkaline soils makes the addition of sulfur both expensive and dangerous to plant growth.

Experiments are being conducted to determine the effect of long rotations on the incidence of scab. Some experimental results have shown that if no potatoes have been grown on soil for several years, scab apparently dies out. On the other

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hand scab will often develop on potatoes growing in soil that had never been planted to potatoes.

The most promising control of scab appears to be that of resistant varieties. The U. S. Department of Agriculture and the Colorado Agricultural Experiment Station, are cooperating in testing a large number of new scab-resistant varieties in several areas in the State. From these numerous varieties it is hoped will be found one or more varieties that are adapted in the areas in which they are to be grown. Several late-maturing varieties that are highly resistant to scab have been produced, but the great need appears to be a scab-resistant early variety to take the place of the highly susceptible Cobbler and Triumph varieties. Continued cooperation of growers with the Experiment Stations should contribute to the solving of this always present scab problem.

The fungus which causes the Rhizoctonia disease also lives in the soil and infects both plants and tubers. The damage done by this disease is more dependent on temperature and moisture than is scab. Rhizoctonia (observed on the tubers as "dirt that won't wash off") is a problem during the cooler seasons of the year. It manifests itself in the early sections as lesions on the underground stems and stolons. Often serious damage occurs in cool wet weather. The organism seldom infects plants or tubers growing in warm soils (above 70° F.), and is not a problem on the late-crop plants. It does, however, infect the tubers as soon as they are mature and the soil is again cool. To avoid sclerotial infection on the tubers, dig them as soon as possible after they are mature.

Seed treatment is effective in controlling the stem lesion type of infection on the early-crop potatoes. The sclerotia (hardened brown masses of the Rhizoctonia fungus) on the seed pieces are effectively killed by treatment with corrosive sublimate (1-1000, 1-1/2 hr. soak) or by treating with the organic-mercury dip method. If the sclerotia are large (as large as a grain of wheat or larger) corrosive sublimate treatment is advisable. Smaller schlerotia are killed readily by organic mercury.

Although neither scab nor Rhizoctonia sclerotia on tubers reduce yield of potatoes they do reduce salability and thus there is a monetary loss. Rhizoctonia may reduce yield when it attacks the underground stems and stolons, and treatment of infected seed is a "must" or "should be" operation. This may not completely eliminate Rhizoctonia damage, since the organism does live in the soil and some damage may occur on plants grown from treated seed. The amount of damage due to stem lesions may be greatly increased by planting untreated infected seed. No varieties have been found resistant to Rhizoctonia and it appears that control of this disease will remain one of clean seed or effective treatment of infected seed.

WORK OF THE COLORADO POTATO EXPERIMENT STATION

By W. C. Edmundson*

The work of the Colorado Potato Experiment Station at Greeley at present is largely devoted to breeding for earliness of both red and white potatoes and for resistance to fusarium wilt, scab, and psyllid injury.

Farmers in the irrigated sections who grow both potatoes and sugar beets

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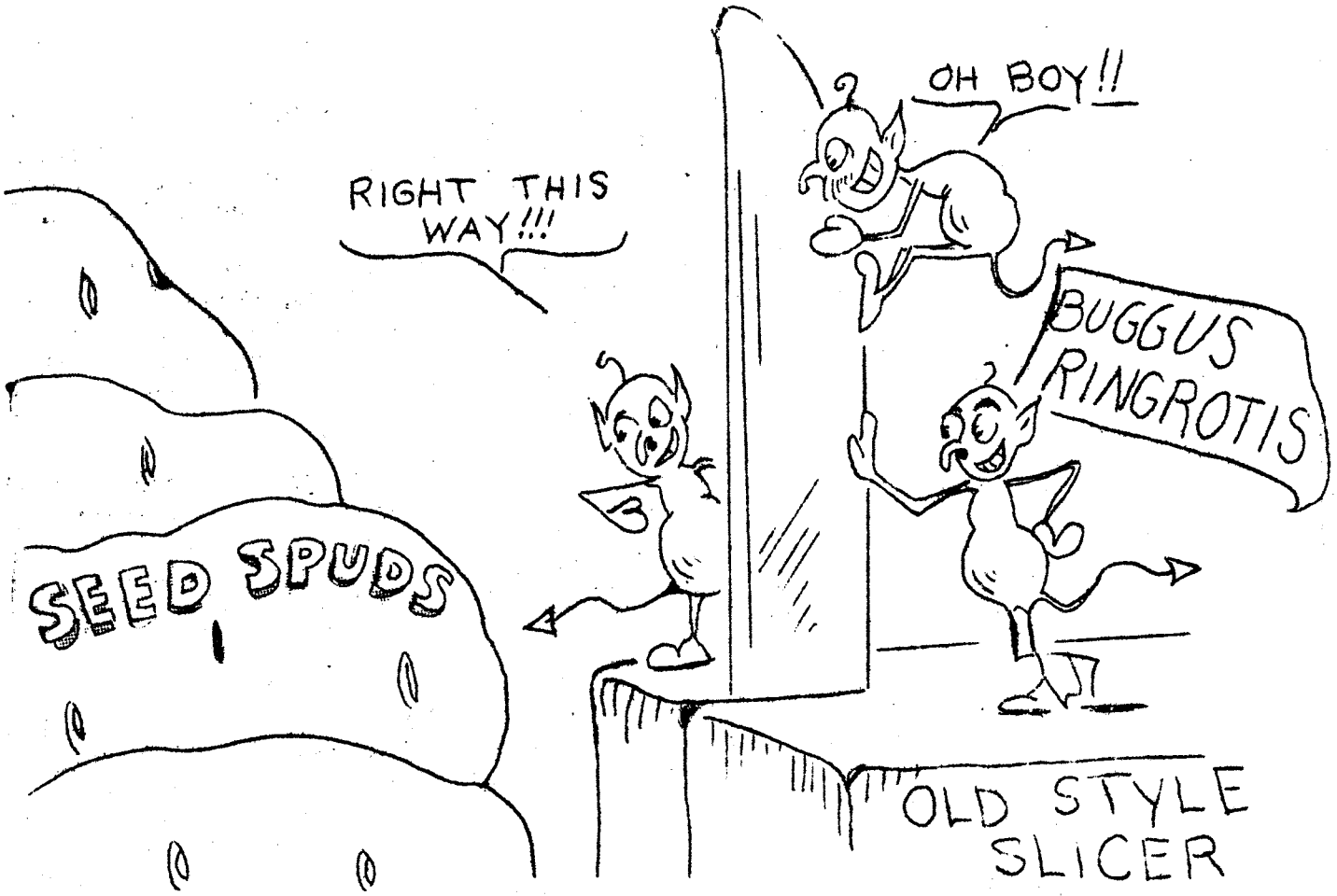
prefer to grow varieties of potatoes that can be dug before they begin to harvest their sugar-beet crop. For this reason a concerted effort is being made to develop early varieties. In some sections of the State a demand exists for a dark red variety having a thick skin, to take the place of Triumph.

Fusarium wilt is one of the important potato diseases of the region. Estimates place the yearly loss at about 5 percent, although in some years it is much greater, especially when soil temperatures are above the average. About 175 seedlings and named varieties are grown in the fusarium test plot each year, and seedlings have been developed that are much more tolerant to fusarium than the commercial varieties grown in the district.

Breeding for scab resistance has become one of the major activities at the Station. This has been made necessary because of the great increase in injury from this disease in recent years, resulting in large losses to growers. Breeding stocks are being gradually improved, and it is hoped that in the near future good commercial scab-resistant varieties will be available. A special effort is now being made to combine early maturity with scab resistance. Two scab-resistant test plots will be located in Colorado this year.

Psyllid yellows, a disease associated with the feeding of psyllids on the plants, is often a very serious disease in Colorado and adjoining states. In some sections it has caused complete crop failures. The disease causes a rolling of the leaves. The leaves of some varieties change to light green or yellow; other varieties become red or purple. The plants generally produce a large number of small tubers which have a short rest period. Breeding and testing for resistance are conducted in the greenhouse at Greeley and in the field in the mountain sections where psyllids are generally present in abundance. This work is carried on in cooperation with the Entomology Section of the Colorado Agricultural Experiment Station.

Another phase of the work is that of testing the new potato varieties in different sections of the State. This work is being carried on by the Horticulture Section of the Colorado Agricultural Experiment Station in cooperation with the U. S. Department of Agriculture.



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