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Large Potato Vines and No Potatoes

...BY...

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*Large Potato Vines and No Potatoes

By Wendell Paddock.

This bulletin contains a condensed account of our work with potato diseases, the most of which has appeared in Bulletins 70 and 91 of this station, and its purpose is to supply information to the increasing number of correspondents who are becoming interested in potato growing. It is addressed primarily to those farmers who live outside of the successful potato-growing sections, but the best potato soils are by no means free from the troubles that are described below. By having a correct understanding of certain peculiar conditions of the potato plant, which have been ascribed to various causes, such as water, alkali, altitude, etc., it is possible that the most successful grower can modify his system of culture to advantage.

Most farmers who have tried to grow potatoes in this state and failed, or who have been only partially successful, will be familiar with the following conditions:

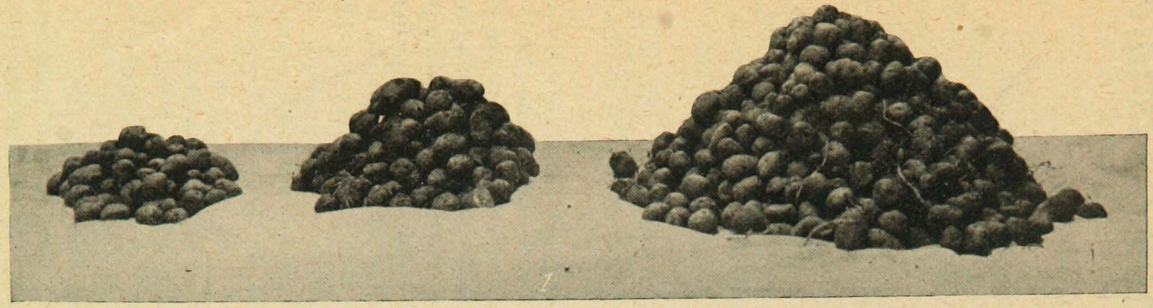
Good vines with no tubers or a cluster of small, worthless tubers; in many instances, even in the best potato soil, the plants fail to come up, or weak plants are produced, which die before the potatoes are mature, thus resulting in a poor stand; potato blight, or the dying of a portion or all of the vines; russeted and scabby potatoes; blight and scab also seen in the best potato districts; and finally, collar rot or black ring of the vine, at the surface of the ground.

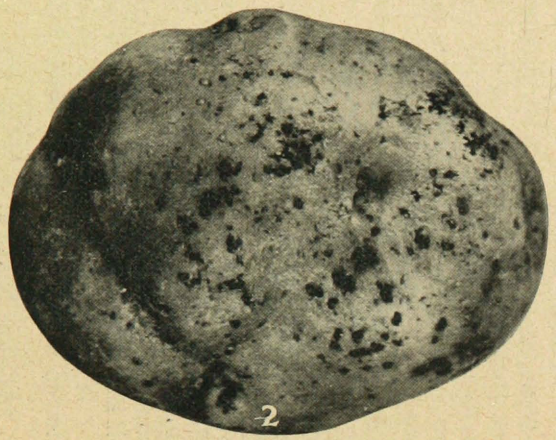
Experiments have proven that any and all of these conditions can be produced by the action of a certain plant disease, and observations in many parts of the state show that this fungus is abundant, and is undoubtedly responsible for most of the lack of success in potato growing.

Nature of the Disease. This fungus (*Corticium vagum* B. & C. var. *Solani,* Burt.) appears to grow naturally in this state, as it is found in the remote and newer parts, and it also attacks a number of plants other than the potato, both cultivated and wild. After the soil has become infected the fungus persists for a long time.

If the fungus is not already present, the soil will soon become infected after potatoes have been grown. This is true for the rea-

*Bulletins 70 and 91, by F. M. Rolfs, being technical in character, have not been sent to the general mailing list. Copies will, however, be sent on request.





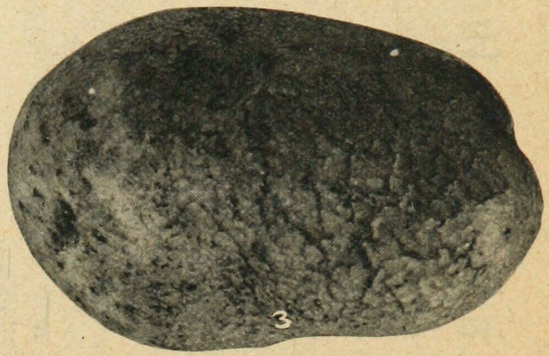


PLATE I.

son that it is difficult to find a sack of potatoes free from all traces of the disease. It lives over winter in the cracks of rough and russeted potatoes and in the ulcers of scab, and also in what appears to be patches of dirt which stick closely to the surface of the potato. By looking closely at these dirt-like appearing objects, which are well shown in Fig. 2, Plate I., it will be seen that they are not composed of ordinary soil. In fact, they are made up of the closely interwoven root-like organs of the fungus.

This tiny plant also produces an abundance of seed-like bodies or spores which help to spread it. They are borne only on green potato vines and just above the surface of the ground. Here a thin, delicate layer is formed that looks like a slight deposit of alkali, and the spores are borne on the tips of the threads of which it is composed.

A Poor Stand of Potatoes. When diseased potatoes are used for seed, or when clean potatoes are planted in infected soil, the fungus starts into growth with the young potato plant. The tender shoots are often attacked, with the result shown in Plate II. On the right are two shoots, which were rotted off by the fungus before they reached the surface of the ground. This illustrates how a poor stand of potatoes is often brought about. The other two were badly injured and might have become mature plants, but affected with the familiar collar rot or black ring.

Vines and no Tubers. The most damage is done, however, by cutting off the tuber stems, and this portion of the potato plant is especially liable to attack. These stems are often cut off as fast as they grow out, thus leaving no place on which tubers may form. But in some instances a cluster of small or "Little Potatoes" form around the main stem, seemingly the result of girdling by the fungus.

Potato Scab. The potato tubers are often made rough and scabby by the growth of the disease on their surfaces. (Plate I., Fig. 3.) All gradations of these injuries may be found, from a rough or russeted appearance to deep scabs or ulcers that greatly injure the appearance of the potato. Singularly enough, scab is more common in the best potato soil than it is in localities where the crop is precarious. Sandy or gravelly soils, when first brought under cultivation, often give a large per cent. of scabby potatoes, but after one or more crops of alfalfa have been plowed under, this tendency is partially corrected.

Potato Blight. Potato blight, or the dying of the leaves and vines before the crop is mature, is commonly thought to be entirely due to diseases which attack the top of the potato plant. We have not found it so in Colorado. Spraying experiments with Bordeaux

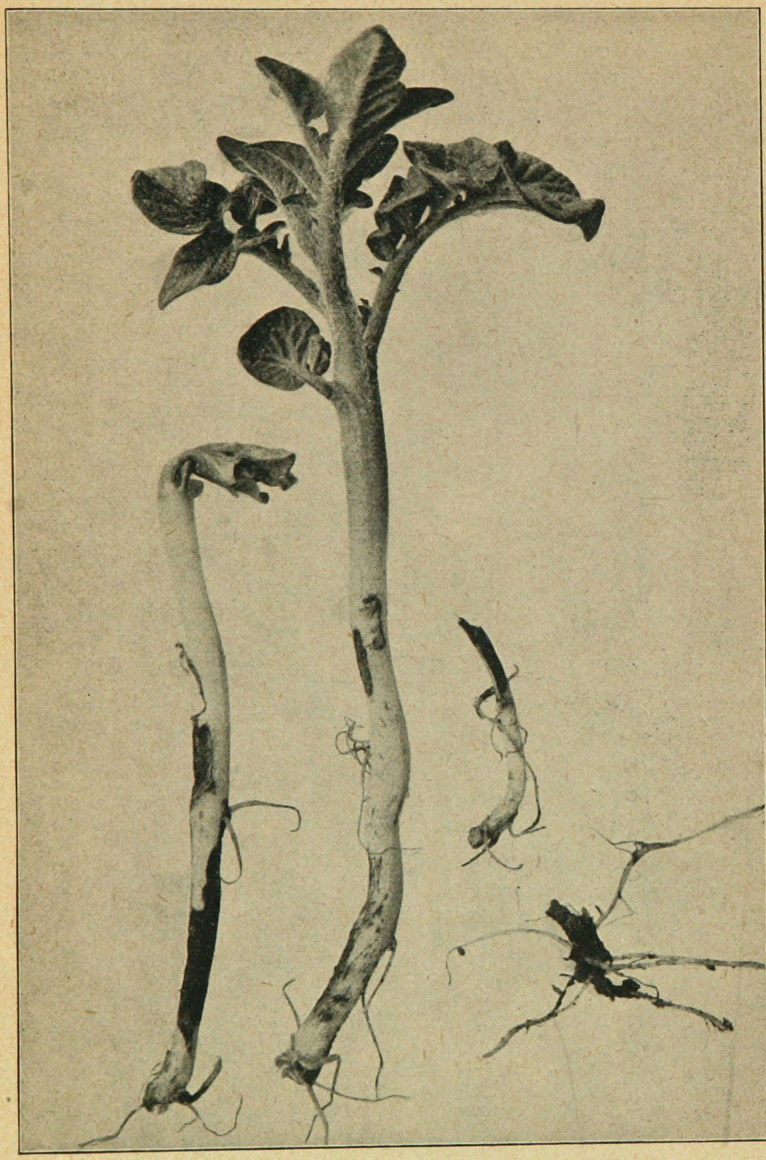


PLATE II.

mixture did not materially lessen the blight, and the microscopic plants which cause these leaf diseases are not commonly found associated with this trouble. We conclude, therefore, that the premature dying of the potato vines is usually an evidence that the underground parts have been severely injured by the fungus in question.

Running Out. The running out of potatoes, as it is called when the tubers become pointed or much elongated, appears also to be associated with the attacks of this fungus. But just what the relation is between the two has not yet been determined.

Treating the Seed. At first thought it would appear to be a simple matter to combat this disease by treating the seed with formalin or corrosive sublimate. In fact, some of our experiments with treated seed have shown decided gains, but others have given a loss. The results of this season are again negative, so it is doubtful if the seed treatment can be made to pay. This is true for the reason that most Colorado soils are thoroughly infected with the fungus and the treatment usually delays the sprouting of the seed and consequently injures the plant so that it does not yield as well as untreated seed.

Seed Selection. Better results have been secured by selecting smooth, round seed that was entirely free from disease. Such potatoes are not only free from disease, but the chances are that they were grown on vines that were not seriously affected by the fungus as run out potatoes usually occur on diseased vines. We would expect such seed to show a certain degree of resistance to the disease.

Disease-Resistant Varieties. The only prospect that we now have of ever overcoming this disease beyond what can be done by improved methods of culture, is to select seed from the healthiest plants that produce good shaped tubers, and thus gradually breed up a resistant strain. Last year over 80 varieties of potatoes were grown in the College garden in soil that was known to be badly diseased. Only 20 kinds out of this number were saved for further testing; the rest produced only a few small, misshapen tubers, and many of the vines bore none at all. This year the list has been still further cut down, though a few varieties yielded well. These were all dug by hand, and the hills that produced the best tubers have been saved for further testing. We hope in time to build up a strain of potatoes that will resist the attacks of this fungus by selecting from individual hills that are the least attacked by disease.

Not many potato growers can afford the time to follow up experiments of this kind, but a less rigid method of selection could be practiced by all. The following is quoted from Bulletin 91, of this Station:

"Another method which gives evidence of considerable practical value is to set aside each year five or ten acres of land for the growing of seed

potatoes. The soil of such tract ought to be fertile and free from the various diseases which attack the potato plant. The tubers used in planting the seed tract are carefully selected each year from the seed plat of the previous year. The surplus seed is used for planting the gneral crop, and in this way a stain of pedigree potatoes is gradually developed."

Culture. The best potato soil is a sandy or gravelly loam which contains an abundance of vegetable matter, and which is well underdrained. In the Greeley district the soil will average about four feet deep. Below this is an immense layer of gravel, which insures perfect drainage. Vegetable matter is secured by plowing under alfalfa sod. Alfalfa is grown two years, then turned under in the spring and planted to potatoes. Two crops of potatoes are grown in succession, then wheat is sown and the land again seeded to alfalfa, thus making a five-year rotation. The second crop of potatoes, however, is rarely as good as the first, probably because of the increase of the fungus in the soil, and in most localities but one crop of potatoes should enter into the rotation system.

A heavy alkaline soil, that has poor underdrainage, furnishes an ideal condition for the growth of this plant disease, and it is in such soils that potato failures are most frequent. But poor underdrainage in any soil is conducive to its growth. It will be seen, then, that cultivation and irrigation must be important factors in controlling the disease. Most people who attempt to grow potatoes make the mistake of using more water than is necessary for the best growth of the plants. The rows should be comparatively short, so that part of the ground will not need to be over-watered. The seed should be planted about four inches deep in rows 38 to 40 inches apart. The furrows should be about five inches deep for the first irrigation, and with subsequent irrigations they should be increased in depth. The idea is to make the furrows deep enough to supply sufficient moisture to the roots without saturating the upper portion of the ridge where the tubers form. Cultivation should follow as soon after as the ground is in condition to work. The condition of the soil and plants should always govern the amount and the frequency that water is applied.

After all has been done in the way of culture, seed selection and a long rotation of crops, the vines and weeds should be collected and burned each season after the potatoes have been dug. This will destroy a great deal of the fungus that would infect other fields, as the vines are scattered by various means.