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AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS
W. B. BIZZELL, President

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DIVISION OF PLANT PATHOLOGY AND PHYSIOLOGY

FIELD DISEASES OF THE SWEET POTATO IN TEXAS

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*In cooperation with the School of Veterinary Medicine, A. & M. College of Texas.
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BULLETIN NO. 249. SEPTEMBER, 1919.

FIELD DISEASES OF THE SWEET POTATO IN TEXAS

BY J. J. TAUBENHAUS.

Recent investigations have shown that we have as yet but few field diseases to contend with in Texas. This is true not because our Texas growers have in the past taken extraordinary precautions to keep out diseases, but it is due rather to the fact that sweet potatoes have been heretofore grown on a limited scale and mostly from seed potatoes produced at home. Since this crop is rapidly coming into prominence in our system of agriculture, and because large quantities are being shipped in from other states for seed, it is to be expected that numerous diseases which are very serious may now gain a foothold in Texas. It will be to the interest of our growers to acquaint themselves with the sweet potato diseases in order that systematic measures may be taken to prevent new maladies from being introduced, and to reduce our present losses to a minimum.

The Division of Plant Pathology and Physiology of the Texas Agricultural Experiment Station will be glad to receive diseased specimens for identification, and to give any other assistance at its command.

In order to give the grower a clearer idea of the nature of the sweet potato diseases, a brief description of the causal organisms as they appear under the microscope is here presented.

SEED TREATMENT.

Field diseases of the sweet potato are in most cases carried with the seed. If no steps are taken to eliminate this source of danger, we will soon be confronted with the colossal task of dealing with lands which have become "sick" to sweet potatoes.

Sweet potato seed should not be treated with formaldehyde, as is often recommended for Irish potatoes. Investigations by the writer* and by Harter† have shown that the use of fomaldehyde is not efficient in controlling the diseases of the sweet potato. Instead, the corrosive sublimate treatment should be resorted to because of its efficiency as a fungicide and because of the stimulating effect which it exerts on the resulting sprouts.

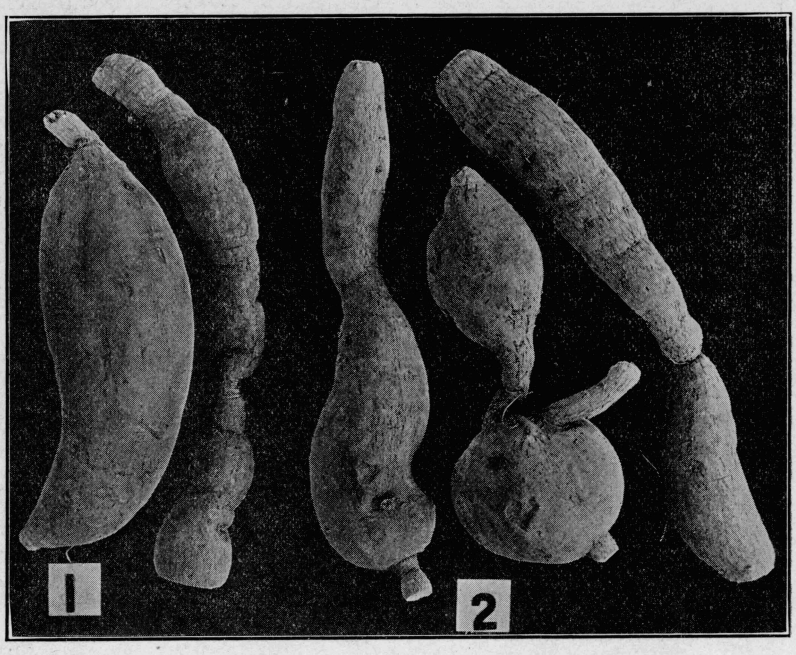
After carefully selecting the seed sweet potatoes for shape (Fig. 1) and discarding all the "shoe strings" (Fig. 2), they should be disinfected with corrosive sublimate solution. This treatment aims at killing the spores of the various disease producing organisms which adhere to the surface of the sweet potato skin. As it is seen, the treatment is in-

*Taubenhaus, J. J., Del. Agr. Expt. Sta. Bul. 109:3-55, 1915.

†Harter, L. L., U. S. Dept. of Agr. Circ., 114:15-18, 1913.

tended as a protection for the healthy seed sweet potatoes. Where a disease has already penetrated the interior of the tissue, no amount of exterior treatment will be of any value. Diseased sweet potatoes should, therefore, never be used for seed.*

The treatment is as follows: One ounce of corrosive sublimate (also known as mercuric chloride) is dissolved in eight gallons of water. As the chemical is not quickly soluble, it is best to dissolve it in lukewarm water or in cold water over night. No metalware should be used, as it will corrode, but instead use should be made of porcelain, or wooden vessels, such as half or whole wooden barrels (Fig. 3). Usually when large quantities of seed are to be treated it is desirable to prepare enough of



SWEET POTATO SEED.

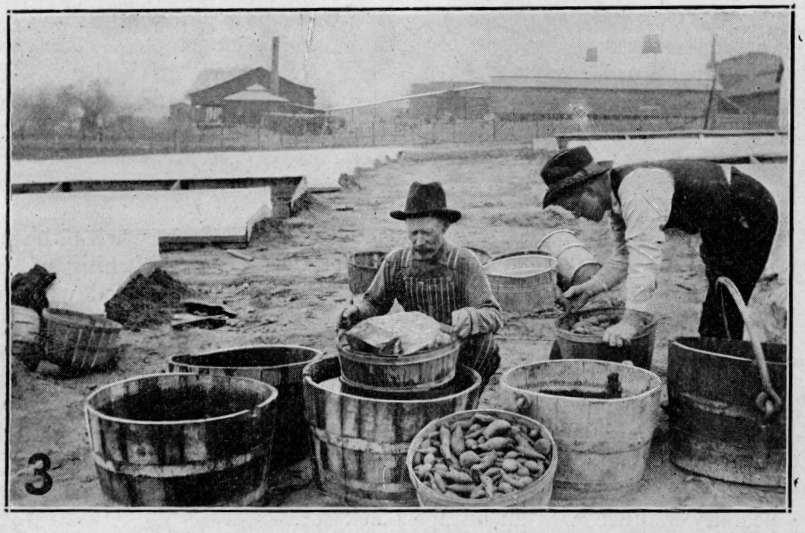
1. Ideal type to use. 2. Kinds of "strings" not to use.

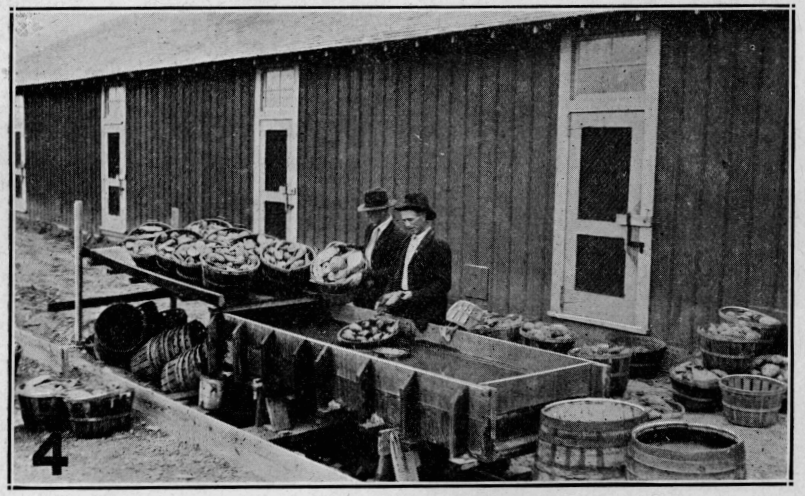
the solution to make five or ten barrels. The same solution may be used over again until it is exhausted. If barrels are scarce, wooden tanks (Fig. 4), or dipping vats, may be constructed for that purpose. One bushel of the seed potatoes may be placed at one time in an ordinary sack or hamper and dipped in the corrosive sublimate solution for ten minutes. The sack or hamper should be carefully moved about so that every potato within is immersed and wetted by the liquid. As soon as the hampers or sacks have dripped off the excess of the disinfectant and immediately after the soaking, the potatoes should be planted in the hot-

*The sweet potato as a rule does not blossom, hence no true seeds are produced. The term seed referred to in this manuscript, means the sweet potato root which is bedded in the hot bed.

bed. Rinsing the treated potatoes with water will remove the corrosive sublimate and defeat the purpose of the treatment.

Corrosive sublimate may be bought from any drug store. The price, of course, will depend on the amount bought. Growers producing large





SEED TREATMENT

3. Method of corrosive sublimate treatment in half barrels. 4. In wooden tank specially prepared.

numbers of sprouts may combine and buy the chemical cooperatively, direct from the chemical plants, at a reduced price. Frequently such arrangement may be made with the local druggist. It should not be forgotten that corrosive sublimate is a poison, hence it should be promi-

nently labeled as such. Moreover, when dissolved in liquid form, care should be taken that neither chickens nor any other stock on the farm be allowed to drink from it, as it is a violent poison when taken internally. No injury will result to the operator, however, from dipping the hands into it, or spilling it on the clothes.

In years of scarcity of seed the jumbo sweet potatoes are often used, in which case they are cut up into halves or quarters. If these are planted without being treated they may soft rot in the hotbed. Some growers make it a practice to dip these slices in a mixture made of equal parts of fresh powdered stone lime and flowers of sulphur. It is preferred that the slices be treated in the corrosive sublimate in the usual way as for unsliced seed sweet potatoes, instead of merely being powdered with the lime and sulphur mixture.

From a practical consideration the only step necessary with the hotbed is to use fresh clean sand every year. At the beginning of each season the old soil should be removed and the hotbed filled with new sand. In using new sand every year it will not be necessary to resort to the use of soil disinfectants. This will mean a saving of labor, and will avoid unnecessary expense for chemicals. The average sweet potato grower in Texas is generally very busy during bedding time and welcomes every opportuntiy to simplify his agricultural practices. Neither is it necessary to use any fertilizer for the hotbed, since the sprouts derive all their nourishment from the mother potato. The use of fertilizer, especially manure, will encourage black rot.

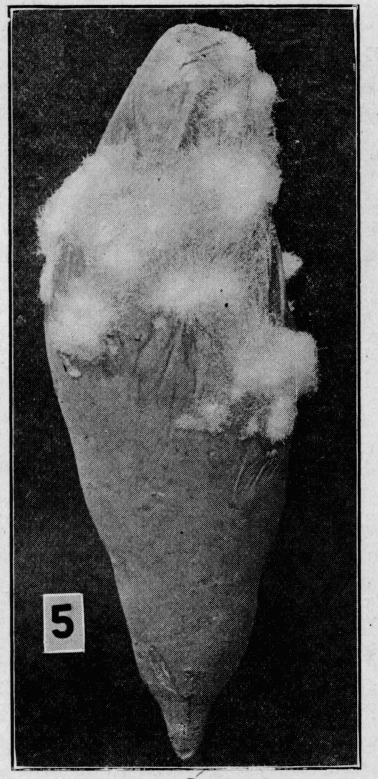
DIPPING SPROUTS.*

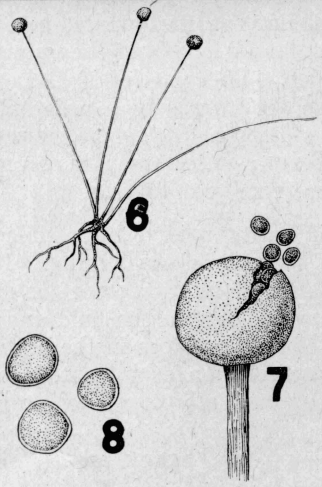
The question is frequently asked whether or not it is desirable to dip sprouts before planting in the field. It may be safely stated that it is not necessary to dip sprouts. This is especially uncalled for where clean sand has been used in the hotbed and where the seed sweet potatoes have been carefully selected and treated for disease. Dipping sprouts in the same strength of corrosive sublimate and for the same length of time as is recommended for the mother roots, is unsafe, as serious burning injury may result to the tender stems and foliage. On the other hand, if the sprouts are merely dipped and taken out of the solution, no particular benefit will result, and the operation will only entail unnecessary labor.

SOFT ROT.

Economic Importance.—Soft rot cannot be considered a field disease. Its greatest damage is done in the storage house. It is often met with in the field at digging during wet weather. This disease is frequently met with in the hotbed, especially where banked or kiln-dried seed sweet potatoes are handled roughly and not disinfected before planting. In the field the damage from soft rot is very slight, not averaging more than one-half of one per cent. In the hotbed, however, from 20 to 50 per cent. of the bedded roots are often destroyed.

*The term "sprout" is used here instead of "slip." A sprout is a rooted plant separated from the mother root in the hotbed. The term "slip" is confusing, because in many sweet potato sections in the United States it is referred to as a "vine cutting."





SOFT ROT.

5. Soft rotted sweet potato. The white growth is the fructification of *Rhizopus nigricans*.
6. Fruiting branch of *R. nigricans*.
7. Fruiting head of *R. nigricans* cracking open to liberate the spores. (Greatly enlarged.)
8. Spores of *R. nigricans*.

Symptoms.—Soft rot is manifested as a rapid softening of the entire potato. When pressed roughly with the fingers, the tissue readily breaks open and a clear, brown liquid oozes from it. Frequently the potatoes rot only in a ringed area in the center, or in any other part of the root, giving it the form of a ring rot. This, however, is only another stage of the soft rot. When rotting first starts, the potatoes become covered with fungus tufts of the parasite, which are made up of numerous fruiting heads of *Rhizopus* (Fig. 5). In the field or in the hotbed soft rotted potatoes when allowed to remain in the soil will soon be invaded by various bacteria and fungi, and as a result will smell badly, finally disappearing by disintegration.

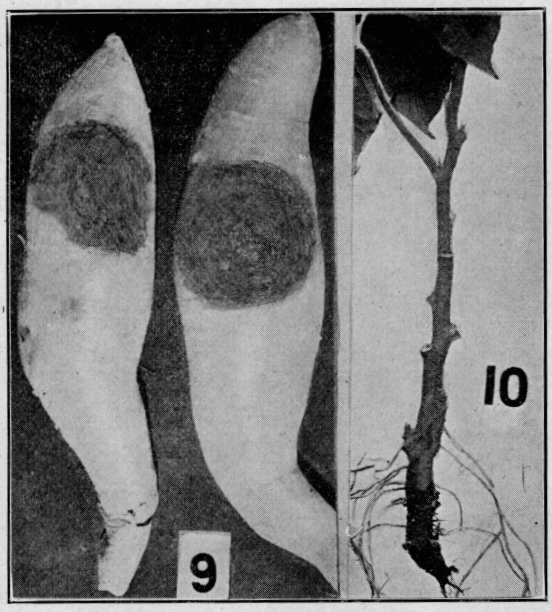
Cause.—The cause of soft rot is a fungus known to science as *Rhizopus nigricans, Ehr.* This organism is commonly known as the broad mold fungus, ordinarily found growing on bread kept damp. In Texas another closely related species, *Rhizopus batatas,* Nak., is found to produce a soft rot on sweet potatoes which cannot be distinguished from the rot produced by *Rhizpus nigricans. R. batatas* has been found in New Jersey by Schwarze.* *Rhizopus nigricans* is characterized by a luxuriant growth of white coarse fungous threads, which become almost black with age. The spore-heads (*sporangia*) are spherical, blackish olive, and are borne on erect-branched spore stalks (*sporangiophores*) Figs. 6 and 7. The spore-head, or *sporangium,* is separated from the spore stalk by a hemispherical cap (*columella*). At maturity the spore-head bursts open and liberates a large number of spores which are gray to brown and spherical (Fig. 8). *Rhizopus batatas* is characterized by a less luxuriant growth of snow white fungous threads, which gradually become browned. The spore stalks are formed in groups of one to seven. The spore-heads are globular, at first white, becoming black at maturity. The spores are irregular in form and the outer wall is wrinkled, usually gray or brown in color. Both species of *Rhizopus* produce sexual spores (*zygospores*). These are formed by a union of male and female sexual threads (*gametes*). The zygospore stage, however, is not frequently met with, and does not seem a necessary part of reproduction or of carrying these organisms over from year to year.

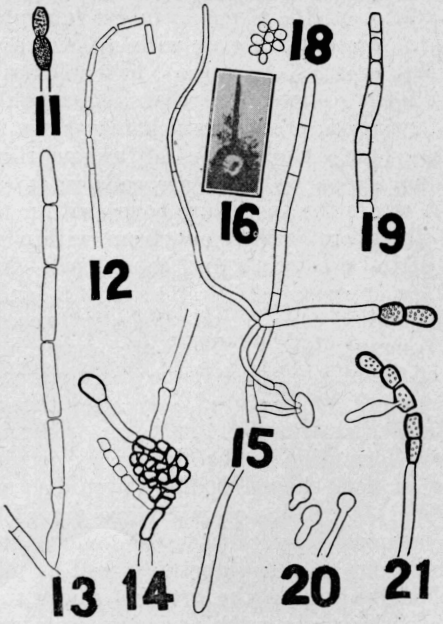
Control.—It is, of course, next to impossible to control soft rot of the sweet potato in the ground before digging. In this case, however, advantage should be taken of mild weather for digging and especially not allow the crop to stay too late in the field and become injured by frost. To prevent soft rot of seed potatoes in the hotbed, they should be soaked in corrosive sublimate solution as indicated above. Where this is carried out there will be practically no rot to contend with.

BLACK ROT.

Economic Importance.—Black rot is one of the worst diseases of the sweet potato in Texas. It is found in practically every soil where this crop is now growing, although more abundantly in the heavier lands. Besides being a serious field disease it is also met with in the hotbed as well as in storage. In the hotbed it not only reduces the number of

*Schwarze, C. A., N. J. Agr. Expt. Station, Bul. 313:3-226, 1917.





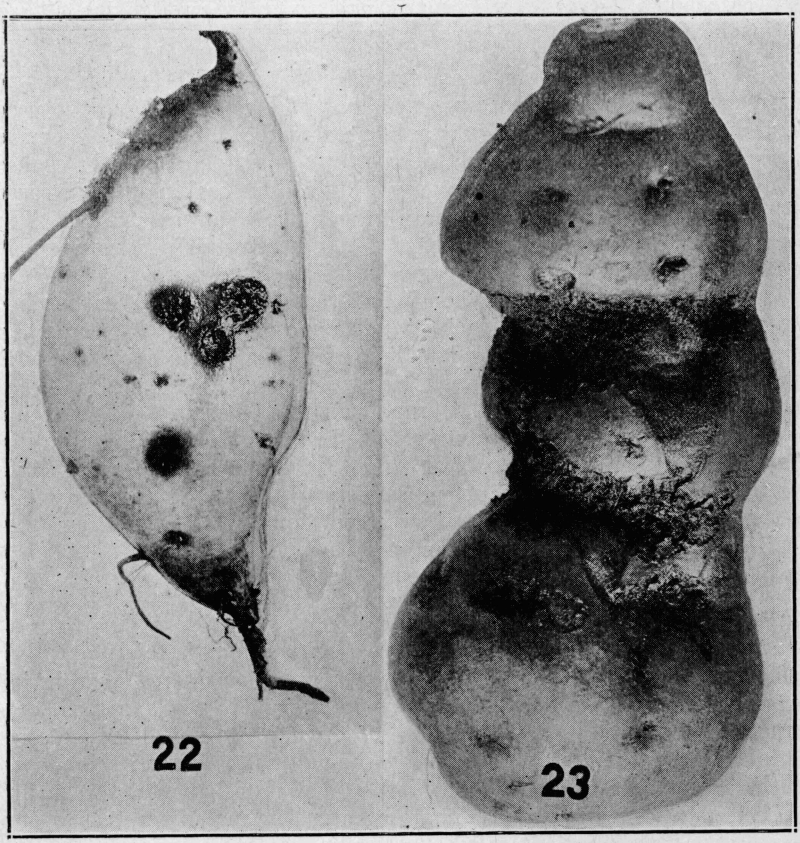
BLACK ROT.

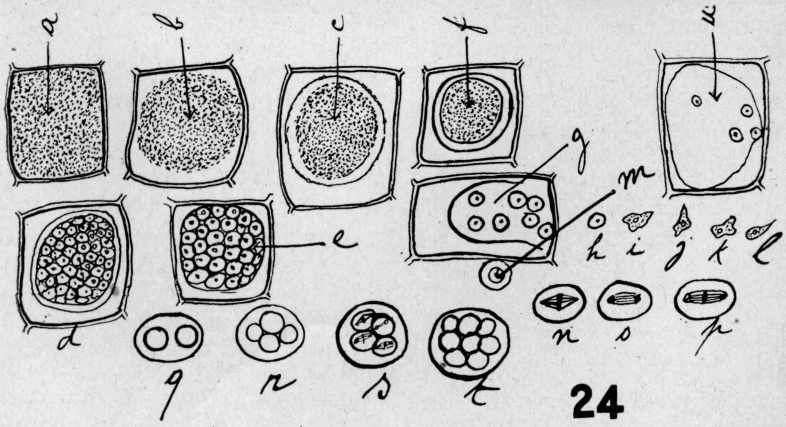
9. Typical black rot spot on roots. 10. Black shank stage on sprout. 11 to 22. Various fruiting stages of *Sphaeronema fimbriatum.*

sound sprouts, but plants derived from infected seed help to carry the disease to the field. Some growers claim that sweet potatoes mature much earlier when grown in land badly infected with black rot, and for this reason prefer diseased land. This cannot be too strongly condemned, for infected land means diseased potatoes.

Symptoms.—On the sprouts black rot is characterized as a black semi-dry rot at the foot of the plant, generally known as black shank (Fig. 10). In the field the disease often attacks the vine, blackening and shriveling parts of the foliage or vine. The most typical symptom of black rot is on the roots. It is manifested as a surface, smooth, dry, round silver-dollar sized spot, darkish to olive brown in color (Fig. 9). Black rot very often follows the opening made by a cut, bruise or wound, the spot naturally following the boundaries of the injury and thereby losing its circular outline. Should there at any time be any doubt as to the exact nature of black rot, all that is necessary is to chew a portion of the diseased tissue. The bitter, quinine-like taste will be sufficient to indicate whether or not the trouble is black rot. Frequently, due to rough handling at digging, hard, dry scabs may be formed on the surface, which often resemble the spots of black rot. As previously stated, however, the presence or absence of the bitter taste will help to determine the nature of the trouble.

Cause.—Black rot is caused by a fungus known as *Sphaeronema fimbriatum* (E. & H.) Sacc. This fungus can best be studied when grown in pure culture and on artificial media in the laboratory. The fungous threads (mycelium) are darkish gray with rather close divisions. When young, it is at first colorless (hyaline), but becomes grayish with age. The reason black rot is so hard to combat is because the fungus has four stages of spore formation, each of which may start infection. A common spore type is where the young or old fungous threads break up into as many individual spores as there are cells in it (Figs. 12 and 13). A second stage is where the spores are borne within the sheath of a terminal cell, and these are pushed out from within (Fig. 19). These spores are very delicate, colorless and short-lived. Another spore stage is known as *chlamydospores* (Figs. 11, 14, 15, and 21). These are olive brown, thick-walled cells, borne singly, in twos or in chains, at the tip end of any fungous thread. They are formed in great abundance within the cells of the affected host tissue and apparently serve as resting spores. These can become liberated only after the sweet potato is put in the ground and disintegration starts in from rotting. Finally, a last stage of spore formation is that known as pycniospores (Fig. 18). These are borne in flask-shaped bodies (pycnidia) which possess long slender necks (Fig. 16). The pycniospores are globular, minute and ooze out, as a gelatinous droplet at the open end of the long neck of the pycnidium. Numerous minute insects, as well as mites, are very fond of these, and when feeding on the droplets smear their bodies all over with the spores, thus spreading the organism from potato to potato and from plant to plant. The pycnidia are generally formed in the center of the spot, in which case the long necks pierce the skin of the sweet potato and may be readily observed with a magnifying lens as minute, pointed, black hair-like appendages (Fig. 16). High temperature and





POX.

22. Pox spots on roots in the field. 23. Disfiguration of root due to pox. 24. "a" to "u" stages in cyst formation and amoebe.

moisture are both necessary for the development of the pycnidia and the pycniospores, both of which conditions generally exist in the hotbed and in the field during the growing season.

Control.—Before bedding, a careful selection should be made, and no potato which shows the least speck or spot of black rot should be used for seed. Neither should the diseased potatoes be discarded or dumped in the field. On the other hand, these infected potatoes should be cooked and fed to stock, or else buried very deeply. In cooking the diseased sweet potatoes the germs which cause these maladies are destroyed. The sound seed potatoes should be soaked for ten minutes in corrosive sublimate as already indicated on page 4. In the field there is little that can be done to save the crop when it is infected. The practical method is to rotate the crop so that black rot will have no chance to become permanently established in the land. Fields which are badly infected with this disease should be given a rest from sweet potatoes for several years, but may be planted to any other crop. On fields known to be badly infected with black rot, the potatoes should be dug early and the crop disposed of at once and not stored. Freshly dug sweet potatoes with slight infection may be used for eating purposes provided the spots are cut out. On the other hand, when infected sweet potatoes are put in storage they will become useless for eating purposes.

"POX" OR "PIT" (SOIL ROT).

Economic Importance.—Compared to black rot, pox is fairly prevalent in fields in Texas. In fact, this disease may be considered next in importance to black rot. Pox, as far as is known, is not a hotbed, or a storage trouble, but purely a field disease where it may often occasion the total loss of the crop. As recently shown by the writer,* this disease attacks not only the sweet potato, but also the Irish poato, the turnip, the beet, and possibly also the tomato plant. The malady is worse where the soil has been limed or where heavy applications of wood ashes have been made.

Symptoms.—Sweet potatoes grown on infected lands are dwarfed, giving the impression of an exhausted soil. This, however, is not the case, since the same lands produce good stands and heavy yields of other crops In pulling out a diseased sweet potato plant from an infected hill, it is generally found that the feeding rootlets are lacking. This is especially true when examination is made at the season of maximum growth. Many of the feeding rootlets will be totally destroyed, while others will have numerous brownish, water-soaked spots at various intervals. Pox also attacks the larger edible roots, in which case numerous dark, round, water-soaked spots may be found scattered about on the potatoes (Fig. 22). These roots, when dug and stored away, will take on a pitted appearance, because during curing the spots become dry and drop out, leaving a pit or scar, whence the name of the disease. Frequently pox attacks the roots in the middle. In such a case growth ceases at that place and enlargement continues at both ends, leaving a constricted area and

*Taubenhaus, J. J., Pox or Pit (Soil Rot) of the sweet potato, Jour. Agr. Research, 13:437-450, 1918.

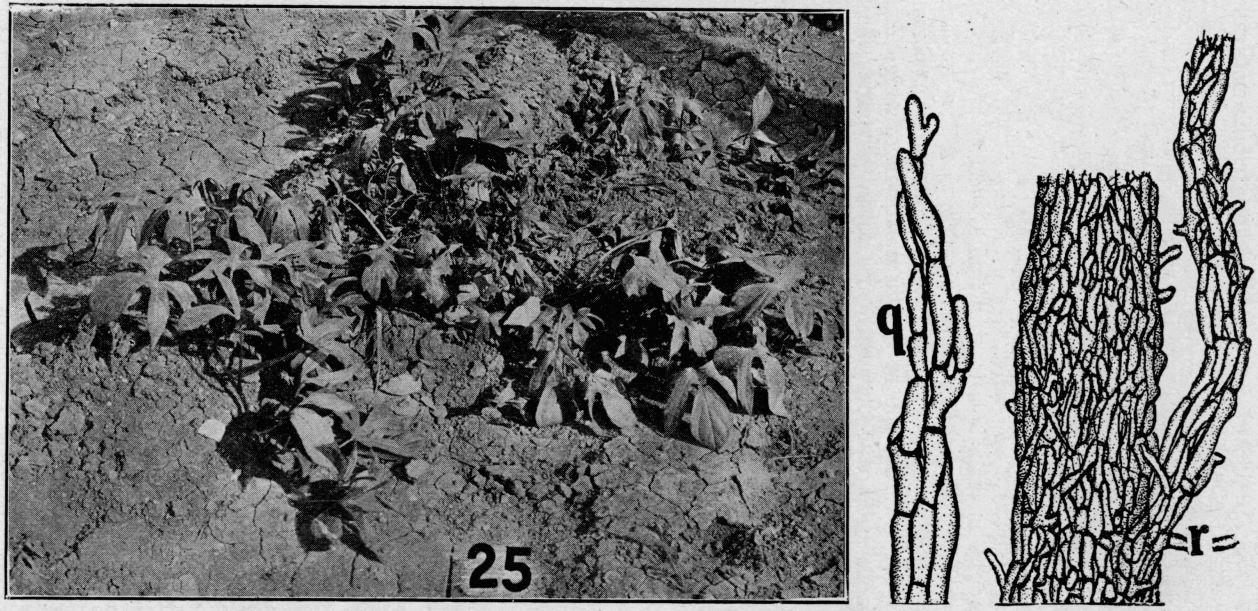
resulting in a deformed potato (Fig. 23). Pox does not work very deep in the larger roots and does not affect the edible quality of the potato, hence the damage in this case consists only in a reduction of yields and the production of deformed potatoes, which naturally brings lower prices.

Cause.—The cause of this disease is a slime mold known as *Cystospora batatas,* Elliot. The organism undoubtedly lives over in the soil, where it is capable of standing high temperatures and considerable drying. The organism is probably wintered over in the soil as resting spores (cysts) which have heavy walls (Fig. 24, "f"). As the cyst is ready to germinate, its wall becomes thinner, finally tearing open and liberating the swarm spores (Fig. 24, "d," "e" and "g"). These minute individuals move around in the soil until they find a sweet potato root, in which case they penetrate through the epidermis (skin) of the host. At other times infection takes place by means of a slimy mass (plasmodium). The latter, after entering the hosts and destroying the cell contents of the tissue, apparently comes to rest, and later the entire mass breaks up into numerous swimming spores (swarm spores). Each one of these is capable of new infection. After the organism has killed a number of cells, which results in the pox spot, it leaves the host and goes back to the soil, apparently to rest and to pass over winter.

Control.—As far as is known, pox does not seem to be carried within the seed sweet potatoes. When the roots are all dug and put into storage, pox spots dry and drop out, thus leaving a pit. Such potatoes, when used for seed, seem to produce absolutely healthy sprouts. In fact, the writer knows of innumerable cases where pox-infected seed were bedded in the hotbed and the resulting sprouts planted on new soil, and not a single case of pox developed. At the same time it is necessary to treat pox-infected seed, as otherwise it may carry the spores of black rot or other sweet potato diseases (see p. 4). Pox apparently spreads from field to field, as cysts, with blowing sand particles. Infected fields should not be limed, as such treatment will increase the disease to a considerable extent. Moreover, badly infected soils should be given a rest from sweet potatoes, Irish potatoes, beets, turnips, and even tomatoes, for at least three years.

TEXAS ROOT ROT.

Economic Importance.—Texas root rot is one of the important sweet potato diseases in Texas, and often altogether prevents our farmers from growing the crop. Fortunately this disease is not found in the typical sweet potato sandy lands. It is, however, very prevalent in the heavier soils, and for this reason is of considerable economic importance. Texas root rot is only a field disease, but not a hotbed trouble. Although the disease generally works in small areas it is not infrequent to find entire fields destroyed by it. This is especially true in the season with moderate rainfall, usually during July, August, and September. During very dry summers Texas root rot is of no economic importance, although under these conditions the drouth is as severe in reducing yields as the disease would be.



25. Sweet potato hill killed by Texas root rot. "q" and "r", fungous threads of *Ozonium* (q and r after Duggar).

Symptoms.—In appearance Texas root rot somewhat resembles foot rot. A hasty glance at the former disease will not reveal anything striking in the field. A careful examination, however, will show a yellow color of the leaves accompanied by a slight wilting. Examination of an individual infected hill will reveal the fact that the center of the plant (Fig. 25) has been destroyed and that the remaining vines continue their existence owing only to secondary rootlets which are formed at the nodes of the vines close to the ground. In digging out the center of the hill it is frequently found that the fungus has worked down deep and destroyed most or all of the roots, all of which are greatly softened, shrunken, and covered with a growth of yellowish-brown mycelium. Texas root rot of sweet potatoes is the same disease which is so destructive to cotton, cowpeas and okra.

Cause.—The cause of this disease is a fungus known as *Ozonium ominvorum* (Pam.), Shear. The causal organism consists of fungous threads (Fig. 25, "q" and "r") which as far as is known produce no fruiting bodies, hence is classed as a sterile fungus. Duggar* reports having found a fruiting stage which he named *Phyomatrichum omnivorum* (Shear) Dug., and which he thought was the fruiting stage of *Ozonium omnivorum.* While there is no doubt of the existence of *Phyomatrichum omnivorum,* it has not been proved that it is the fruiting stage of *Ozonium omnivorum.* Our own investigations so far tend to show that the Texas root rot fungus is a sterile organism and that it winters over from year to year as sterile mycelium on dead roots of sweet potatoes, cotton, or okra. Further work is now in progress on the life history of *Ozonium omnivorum.*

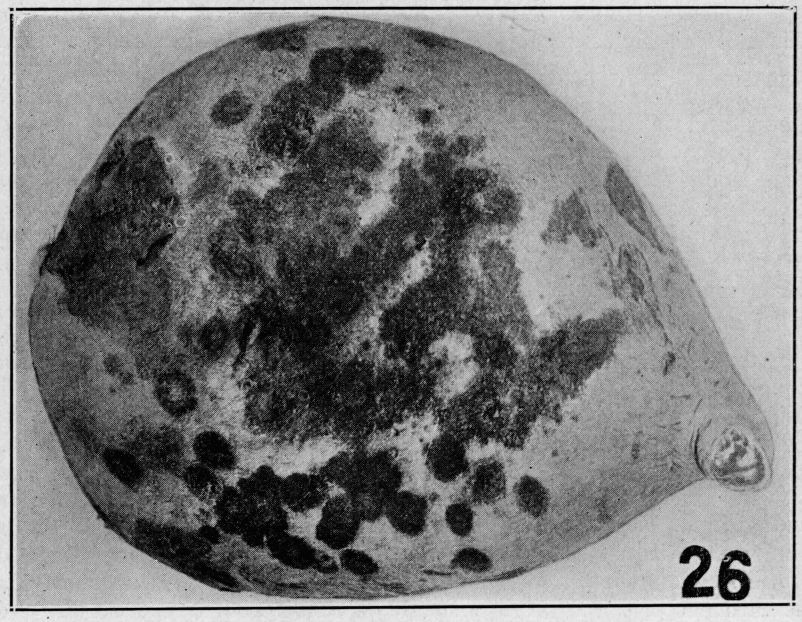
Control.—No definite method is as yet known in the way of controlling the Texas root rot. Infected lands should be given a rest from sweet potatoes for several years. Since root rot also attacks cowpeas, okra, cotton, and a large number of other vegetable crops,† these, too, should be avoided in our system of rotation. On the other hand, grain crops are known to be immune from this disease and should be used instead. Rotation with grains alone, however, will do very little good if the land is allowed to become weedy, since the cockle bur (*Xanthium commune*), the tie-weed (*Convolvulus arvensis* and *C. sepium*); the wild vetch (*Vicia sp.*), are subject to Texas root rot; hence in connection with rotation clean culture is especially recommended.

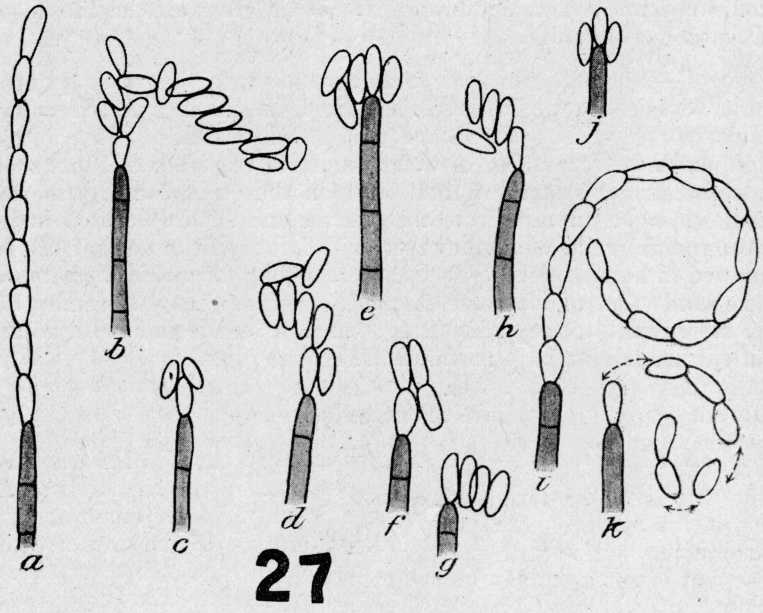
SOIL STAIN OR SCURF.

Economic Importance.—Soil stain is very prevalent in the heavy soils where sweet potatoes are grown. It is common in the red lands of East Texas. Soil stain is a disease of the skin only. It is therefore of indirect importance, because it does not produce a rot, and does not affect the edible value of the potato. The potato roots, however, become stained and do not have a pleasing appearance and are thus objectionable to some markets.

*Duggar, B. M., Ann. Missouri Bot. Gard. 3:11-23, 1916.

†The division of Plant Pathology and Physiology is now making a study to determine which of the Texas economic crops are subject to the Texas root rot.





SOIL STAIN.

26. Soil stain spots on Nancy Hall sweet potato. 27. "a" to "k" method of spore formation of *Monilochaetes infuscans*.

Symptoms.—Soil stain is characterized at first by small, circular, deep clay-colored spots on the surface of the sweet potato root. These spots occur singly, but usually there are several in a given area (Fig. 26). When very numerous, the spots coalesce, forming a large blotch which sometimes takes the form of a band, or may cover the entire root. Soil stain is particularly conspicuous on the white-skinned varieties, such as Southern Queen. Here the color of the spots is that of a deep black clay loam. On the darker skinned varieties the color of the spots does not appear so conspicuous. Soil stain is a disease of the underground parts of the plants. The vines and foliage are never attacked as long as they remain free from the soil. When these are covered, however, the petioles as well as the stems may become infected.

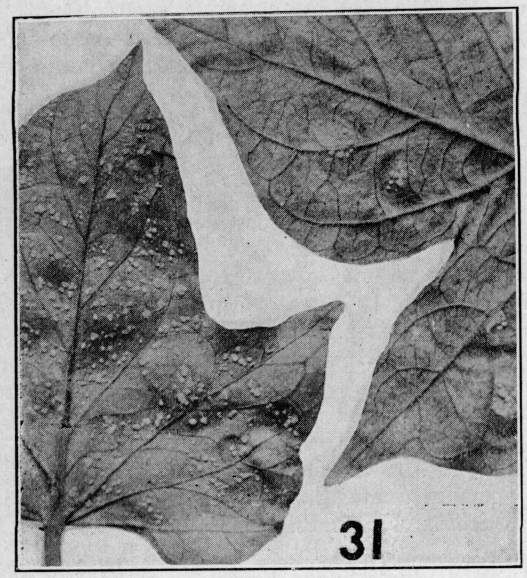
Cause.—The cause of this disease is a fungus known as *Monilochaetes infuscans,* E. and H. This organism is best seen when grown in pure culture on artificial media. The fungous threads are colorless when young and turn gray, then black, and become filled with oil globules when old. The spore stalks (conidiophores) are distinct from the mycelium, and at the tip ends of these are found the hyaline, one-celled spores, which are formed in chains (Fig. 27, "a" to "k"). The spore chains readily break up when moistened by any kind of a liquid, especially water.

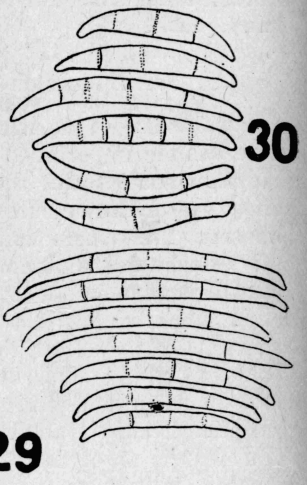
Control.—Since soil stain is carried with the seed, it may be controlled with corrosive sublimate as indicated on page 4. It is not safe to use stained potatoes, even after treatment, because there may be a possibility of their carrying also black rot; hence for practical purposes, such roots should not be bedded. Soil stain is more prevalent in manured lands. Infected fields should be given a rest from sweet potatoes for two to three years.

VINE WILT OR YELLOWS (STEM ROT OR BLUE STEM).

Prevalence.—Vine wilt, or "yellows," is a disease which is as yet of no economic importance in Texas. This, indeed, is very fortunate, because in some states the disease has become so severe as to seriously affect the profitable culture of the crop. In Texas the writer has found but two cases where wilt was prevalent, and in both of these instances the trouble was undoubtedly introduced with imported sprouts. It is not infrequent for seed growers in Delaware and New Jersey or in Virginia, where vine wilt is prevalent, to buy Southern sweet potatoes, especially the Nancy Hall, to bed them, and then reship the sprouts to their point of origin. This, then, is one means whereby the disease is directly introduced in new territory. It is fortunate that most of the Southern varieties, Nancy Hall excepted, are fairly immune to vine wilt. Since vine wilt is a very serious disease, if allowed to become established in the soil, it behooves us to take every possible precaution to prevent its introduction and spread in Texas. Vine wilt is a hotbed and field disease, but is not a storage disease.

Symptoms.—Diseased hills are noticed by a wilting and yellowing of the stems and leaves. During wet weather infected hills may struggle for a long time without dying. During a prolonged drouth, however,





STEM ROT.

28. Hill of sweet potatoes killed by wilt. Notice new growth starting in center. 29. Spores of *Fusarium batatatis*. 30. Spores of *F. hyperoxysporum* (29 and 30 after Wollenweber). 31. White rust.

diseased plants die very early. The causal organism in this case enters through the young rootlets and travels up to the water vessels of the main roots and stems. In severe cases these vessels become so clogged with the fungus as to interfere with the upward flow of water from the roots to the vines and foliage. This, then, gives the plant a wilted appearance, although there may be plenty of moisture in the soil. In light infections only one or two vines may be affected and die, while the others remain sound. After the death of the vines the roots in the soil produce secondary growth, which, however, remains stunted (Fig. 28). The roots in the field, although infected, do not always rot, but may be carried through the storage period in good condition. Such seed, however, when planted in the hotbed will produce diseased sprouts which may then be carried to the field.

Cause.—The cause of vine wilt according to Wollenweber* and others are two fungi known as *Fusarium batatatis* Wr., and *Fusarium hyperoxysporum* Wr. The spores of both of these fungi are sickle-shaped (Figs. 29 and 30) and are frequently formed on the dead vines, giving them a salmon, or flesh color.

Control.—As far as possible no seed or sprouts should be brought from states known to be badly infected with this disease. Moreover, in buying seed sweet potatoes from unknown sources the tip end of the roots should be clipped with a sharp knife, and whenever the interior vessels show any browning they should be discarded and not used for seed purposes. They may, however, be boiled and fed to live stock on the farm. Treating the seed with corrosive sublimate will, in this case, be of no value, since, as has been pointed out, the disease only works in the interior of the vessels of the root and no treatment can reach it. To aid in the control of this disease rotation of crops should be practiced. Vine wilt attacks the sweet potato only, hence infected lands may be put to any other crop.

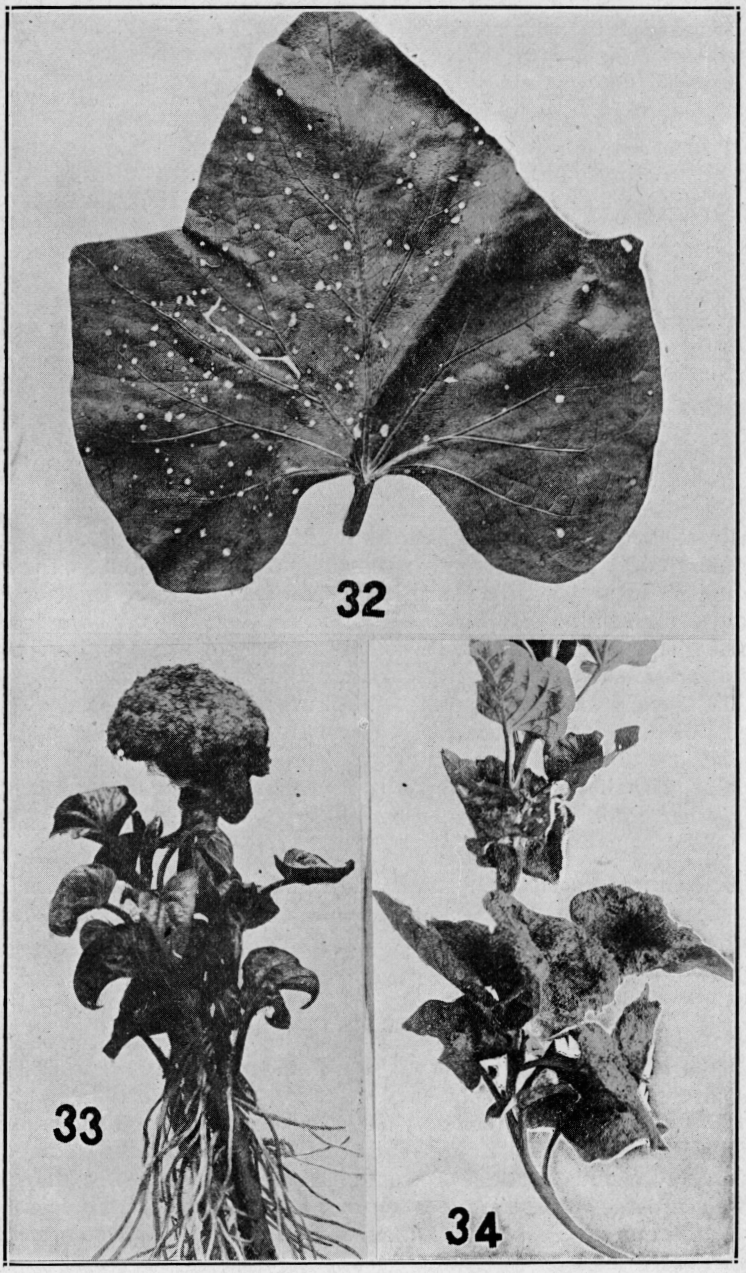
FOOT ROT.

Economic Importance.—As far as is known, this disease has not as yet been found in Texas, and hence is of no economic importance at present. It is prevalent in Virginia, where it was studied by Harter.† It also occurs in Ohio, Iowa, Missouri, Kansas, California, Maryland, and New Jersey.

Symptoms.—As the name indicates, the disease attacks the foot of the plants, resembling somewhat the Texas root rot. It is first manifested as a dark brown spot on the ground level of the vine and works up to a distance of six inches. The foot of practically every vine in the hill is thus killed. The outer ends of the vines, however, remain alive because numerous rootlets are sent out at the nodes. The disease also works into the roots, killing many of them, thereby reducing the yields to a minimum. Foot rot is caused by a fungus, *Plenodomus destruens* Hart.

*Wollenweber, H. W., The identification of Fussarium occurring on the sweet potato. Jour of Agr. Research, U. S. Dept. of Ag. Wash. D. C. 2:251-286, 1914.

†Harter, L. L. The foot rot of the sweet potato. Jour. of Agr. Research, 1:251-274, 1913.



SWEET POTATO DISEASES.

32. Septoria leaf spot. 33. Tip of sprout covered by slime mould.
34. Lower part of vine covered by slime mould.

Control.—Since the disease is carried with the seed potatoes the latter should be carefully picked out before planting. The sand in the hotbed should be removed every year and a fresh supply be used instead. Where the disease becomes bad, the field should be given a rest from sweet potatoes. As far as is known foot rot attacks only the sweet potato.

WHITE RUST.

This is a foliage trouble only and is of minor importance in Texas, since the dry, hot months of July and August help to keep it in check. The disease is characterized as minute, whitish blisters on both the upper and lower sides of the leaves (Fig. 31). When these blisters are ripe they burst open and liberate a white powder which is made up of the spores of the fungus. This disease is not serious and there is little to be done to control it. The cause of the trouble is a fungus known as *Cystopus panduranae* Far.

LEAF SPOT.

Like white rust, leaf spot is confined only to the foliage and is practically of little economic importance. The disease is characterized by minute circular white spots on the foliage (Fig. 32). A careful examination with the hand lens of one of these spots will reveal a few black, minute, flask-shaped bodies (pycnidia), which constitute the fruiting bodies of the fungus. The cause of this leaf spot is a fungus known as *Septoria bataticola* Taub.

SLIME MOULD.

Very often the plants in the hotbed are covered with a white, yellow to purple, slimy, jelly-like growth. This appears in patches of three to six inches or more in diameter, covering all parts of the foliage, petioles and stems (Figs. 33 and 34). In 12 to 24 hours this slimy substance thickens and becomes covered with a white to yellowish crust which readily cracks and liberates a dark brown powder, consisting of the spores of the organism. The growth is a slime mould, which lives only on the surface of the vine but does not attack it as a parasite. Its presence, however, is objectionable, since it usually covers the leaves, shutting out the light and preventing the normal respiration. The causal organism is known as *Fuligo violacea* Pers.

In the foregoing discussions stress has been laid on the necessity of seed disinfection. This method is so simple and the operation so inexpensive that it ought to appeal to all progressive growers. No other chemical poison should be used as a substitute for the corrosive sublimate. In many instances Paris green (an insecticide) has been used by farmers who believed that it would answer the purpose. Crop rotation should be adopted wherever possible. This will prevent important diseases from becoming established in the land. It is high time that our growers realize the importance of constructive legislation which will prohibit the importation or exportation of diseased seed sweet potatoes

or sprouts. In this way only can we keep out important diseases. Growers should closely watch the sweet potato crop in the field and acquaint themselves with the disease problems which face them.

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