INDEXED
Division of Horticulture Catalog

DISEASES OF THE SWEET POTATO IN MISSISSIPPI AND THEIR CONTROL

By D. C. Neal
DEPARTMENT OF PLANT PATHOLOGY

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
Agricultural College, Mississippi,
J. R. RICKS, Director.
Diseases of the Sweet Potato in Mississippi and Their Control

By

D. C. Neal.

Sweet potatoes are rapidly growing in importance as a commercial crop in Mississippi. The production during 1919 totaled approximately 10,300,000 bushels. The yield for 1920 will doubtless exceed this figure. On the basis of these estimates, Mississippi ranks fourth in sweet potato production being excelled only by Alabama, Georgia, and perhaps Texas.

The profits to be gained from such a crop would no doubt be greater if it were not for the numerous diseases to which the plant is subject. The total losses in 1919 as the result of disease attacks is conservatively placed at 40 per cent. Data collected for the State this season (1920) indicates that similar losses will be slightly in excess of 1919. When such a high percentage of loss is added to the actual yield for the State (10,300,000 bushels), one gains some idea as to the inroads made by diseases.

In order that the growers in the State may familiarize themselves with the principal sweet potato diseases, and be able to combat them intelligently and effectively, these are summarized herein, symptoms outlined, and methods of control presented so far as known.

THE TWO CLASSES OF SWEET POTATO DISEASES.

Sweet potato diseases may be divided into two classes, (1) field diseases attacking roots, stems, and leaves, and (2) storage rots. Both groups are important and many of each occur in Mississippi. Field diseases of stems and roots will be taken up separately and discussed first. These include black-rot, stem-rot, foot-rot, scurf, sclerotial-rot, Texas root-rot, and soil-rot.

FIELD DISEASES OF STEMS AND ROOTS.

BLACK ROT.

Economic Importance.—Black-rot is by far the most serious disease of the sweet potato in Mississippi. This disease is no doubt responsible for at least 10 or 12 per cent of all losses encountered in growing, harvesting, and marketing the crop. It is widely distributed over the State, and is perhaps present to a greater or less extent wherever the crop is grown. In addition to being a serious field disease, it is also often present in the seed bed, causing the death of many sprouts and infecting others. If sprouts are set to a field affected with black-rot (black-shank), two serious consequences invariably result. First, the infected plants will produce wholesale soil infection, and the land is rendered unfit for growing potatoes; second, the disease is transmitted to the roots, and black-rotted potatoes will be harvested.

Symptoms.—Black-rot may occur on any of the underground portions of the plant. On the sprouts, it usually begins at the base just beneath the soil line. Here the disease manifests itself as small spots varying from dark-brown to a lamp-black color. These gradually enlarge, extend up the stem, and it is here that we get the stage known as "black-shank" (See Fig 1). In many cases the plants in the seed bed and the field are often rotted off at the base by the shank stage of the fungus. On the roots, the disease is very typical. Here it produces circular, dark to olive-brown colored spots (See Fig. 2). These infected areas vary in size from small to large spots, which may cover more than one-third of the surface of the potato. Sweet potatoes infected with black-rot are very bitter in taste, and this feature alone is very helpful indeed when one is in doubt as to its presence.

Cause.—Black-rot is caused by the fungus Sphaeronema fimbriatum (E. & H.) Sacc. It is a disease of the underground portions of the plant. The
fungus produces several types of spores, and experiments have shown that it can overwinter on diseased vines and tubers left in the field. Infection develops through the roots, either originating from infected soil after the plants

Fig. 1. Black-rot, or black-hank, on sweet potato plants. Note the characteristic blackening at base of sprouts.

are set in the field or developing on plants in the seed bed growing from diseased potatoes. Frequently, plants becoming infected with black-rot in the seed bed die before transplanting. As a rule, however, countless numbers withstand the shank infections, and the disease continues to grow on them. The diseased sprouts are oftentimes set to the field, and the infection is thus transferred to the roots which form on the diseased plants. At harvest the tubers are black-rooted, and when these are placed in storage, the trouble continues to spread and infects healthy surrounding stock.

CONTROL.

Seed Selection.—Careful seed selection in order to insure healthy stock is of primary importance in controlling such diseases as black-rot. If black-rotted potatoes are bedded, the sprouts produced therefrom will almost invariably have black-rot, or "black-shank," as this stage of the disease is sometimes called. As mentioned above, such practice not only serves as a source of infection to the new crop, but the soil is rendered unfit for the growing of sweet potatoes, since the fungus is able to live over in the field on diseased potatoes and vines. Before preparing the beds in the spring, the sweet potato seed-stock should be carefully selected, taking care to discard all potatoes having the slightest trace of black-rot or any suspicious spots. All discarded potatoes should be destroyed in some manner, and in no case should they be
thrown indiscriminately around the beds. These may be boiled and then fed to stock or else buried in some remote place.

*Seed Treatment.*—After the potatoes have been carefully selected, they should be treated with a solution of corrosive sublimate, made by dissolving 1 ounce of the poison in 8 gallons of water. This kills any surface spores or germs that may be present. The seed potatoes should be treated in this manner for 10 minutes. When large quantities of seed are to be treated, large stocks of the solution may be prepared in barrels or wooden tubs (Fig 3). Never use zinc or metal containers for this purpose, since the corrosive sublimate solution corrodes such materials. The potatoes may be placed in sacks or hampers and suspended in the solution, being careful to see that all sides of the potatoes are thoroughly wetted with the liquid. It is, perhaps, more convenient to treat not over a bushel at a time; the same corrosive sublimate solution, however, may be used over again for treating several lots of seed. This disinfectant may be obtained from any drug store at a nominal price. It must be remembered that corrosive sublimate is a deadly poison when taken internally, hence, it should always be handled so that chickens or stock cannot drink from the containers having the poison. It is harmless, however, to the skin or clothing and may be handled with perfect safety.

---

*Fig. 2.* Sweet potato black-rot. Sweet potatoes showing the dark, circular spots produced by the black-rot fungus.
the potatoes have remained in the solution 10 minutes, they may be removed and immediately bedded. No rinsing or removal of the poison is necessary.

*Seed Bed Sanitation.*—The fungus causing black-rot not only reaches the seed bed by being carried there on infected seed, but experiments clearly show that it will live over in the soil of the seed bed or in other soils where infected plants have been grown. The practice, therefore, of using the same seed-bed from year to year should be abandoned. The soil in the seed-bed should be changed.
each year and should be taken from places where sweet potatoes have never been grown. A better plan is to change the location of the seed-bed each year. In case it becomes necessary to use the old framework again, this should also be disinfected with copper sulphate (blue-stone) solution at the rate of 1 pound to 25 gallons of water, or else use a solution of formalin in the proportion of 1 pint to 30 gallons of water. Pure sand may be used in the seed bed; rich soil or fertilizers are not essential, and manure should be avoided as this often encourages black-rot.

_Crop Rotation._—The fact should not be forgotten that the black-rot fungus is a disease which is capable of over-wintering in the soil on diseased roots and other organic materials. It is not definitely known how long the fungus will remain viable in infected soil. Nevertheless, fields which are badly infected should be given a period of rest, and such ground should not be planted to sweet potatoes oftener than once in three or four years.

**STEM ROT OR WILT.**
(Yellow Blight or Blue Stem.)

_Prevalence and Distribution._—Stem-rot or wilt is becoming established in many sections of the State. Specimens have been received this year from the following counties: Lee, Marshall, Prentiss, Chickasaw, Pontotoc, Oktibbeha,

---

Fig. 4. Map showing distribution of sweet potato stem-rot in Mississippi by counties.
Union, Stone, and Lauderdale. See diagram (Fig 4). No doubt much of the infection now reported has been introduced on sprouts from localities where the disease is prevalent. This is one of the ways by which stem-rot is disseminated. In some states, this disease is often responsible for a reduction in yield of 50 per cent, especially is this true in New Jersey, Delaware, southern Illinois, and other states. According to Harter (1), stem-rot is responsible for a loss of at least three-quarters of a million dollars annually to the sweet potato crop in the United States. It is, like black-rot, a seed bed and field disease, but unlike the latter, it does not spread in storage.

Symptoms.—Infected plants ordinarily show a rather distinct difference in the color of the foliage as compared with healthy plants. As a rule, the leaves of the plants reveal a decided yellowing along the veins, the younger or terminal leaves becoming first involved, and then the whole vine, giving the plant a dull, pale-yellow appearance. Wilting follows quite rapidly, especially during a dry season, and the plant soon dies. During wet weather, the infected plants appear stunted but are able to survive for long periods before succumbing to the disease. If one examines a plant infected with stem-rot by splitting open the stem near the base of the hill, it is always found to be blackened inside (Fig. 5).
Frequently this may extend throughout the stem and into the roots, causing the tubers to become infected, (Fig 6.) Occasionally a diseased plant will produce a few potatoes, but they are very small, stringy, and of no market value.

**Cause**—The cause of sweet potato stem-rot is two species of fungi known as *Fusarium batatatis* Wr. and *Fusarium heperozysporum* Wr. These fungi are quite similar morphologically to Fusarium wilts of tomatoes, cowpeas, and cotton. The sweet potato stem-rot organisms, however, are not known to attack any other plant. Infection takes place through the root of the plant, and the fungus gradually works its way to the water passages of the stems and branches. Here excessive growth of the organism plugs the water ducts, and this inhibits water from passing upward to the vines and leaves. Wilting results and causes the yellowing of the vines as heretofore discussed. The disease occurs both in the field and in the seed bed. Field infection develops either from placing healthy plants on ground already infected, or it may arise from transplanting sprouts which have become diseased in the seed bed.

**Control**—Such preventive measures as seed selection, seed-bed sanitation, and crop rotation as given for black-rot, also apply in the case of stem-rot. Growers should, also, make a practice of growing and selecting their own plants or else purchase them from localities where stem-rot does not occur. In selecting seed potatoes free from stem-rot, it is well to carry out the operation in the fall at digging time. By splitting the stem of each hill near the base, stem-rot is easily detected, the tissues inside being streaked with black. Potatoes from such hills should not be used for seed. Seed treatment is of no value in controlling stem-rot, since the disease is confined to the vessels of the potatoes, and no disinfectant can reach it. Where land is already infected, crops other than sweet potatoes should be planted in order to starve out the disease.

**FOOT ROT.**

(Die-off.)

**Economic Importance.**—Foot-rot does not occur to any extent in Mississippi, and at present is of very little economic importance in the State. It is a destructive disease of sweet potatoes in Virginia and has been studied there by Harter (2) and McClintock (3). It is also known to occur in New Jersey, Maryland, Ohio, Missouri, Kansas, California, and Florida.
Symptoms.—Foot-rot, as the name indicates, first manifests itself as dark brown to black areas at the foot of the stem of the plant, as shown in Fig. 7. These diseased areas may extend up the vine 5 or 6 inches, finally girdling the

Fig. 7. Sweet potato stems infected by the foot-rot fungus. Note the dark brown, shrunken area at base of stems. (After J. A. McClintock, Va. Truck Exp. Station, Bulletin 22.)

Fig. 8. A sweet potato infected by the foot-rot fungus. Note shrinkage of the diseased tissues. This is characteristic of foot-rot. (After J. A. McClintock, Va. Truck Exp. Station, Bulletin 22.)
plant. The progress of the disease is somewhat slow, and as a rule, affected plants do not begin to die until late in the summer. Occasionally sprouts of the diseased plants may withstand the attack of the fungus for a time, with the result that a few potatoes may be produced, but these are invariably affected with the disease at harvest time. (See Fig 8). The causal fungus is Plenodomus destruens Hart.

Control.—Since foot-rot is disseminated largely by means of contaminated seed, plants, and vines, the same preventive measures of seed selection, clean seed beds, and crop rotation as already mentioned on pages 3 to 6 should be employed.

SCURF.
(Soil Stain.)

Economic Importance.—Scurf, or soil stain, is a very common sweet potato trouble in many parts of the State. The writer has received a number of specimens affected with the disease the past season. It also occurs widely in other states where the crop is grown. It does not produce a rot of the potatoes but causes a discoloration of the skin. As a result, the potatoes do not have an attractive appearance and command a lower price on the market. Because of the superficial nature of the disease, however, scurfy potatoes are used for food to a great extent; and if no other diseases are present, their edible quality is unaltered. Scurf is responsible for shrinkage in storage. It injures the epidermis of the potato so that there is a considerable loss of moisture.

Symptoms.—Scurf is doubtless familiar to most growers. It is characterized by the formation of brownish spots scattered over the surface of the potato. These may be small, circular, or irregular, and sometimes coalescing to form a continuous discolored area. (Fig. 9.) In severe cases the entire surface may be covered. On the white-skinned varieties, it is particularly noticeable. The discolored or infected areas are, for the most part, present in the field before the crop is harvested, though they may enlarge slightly in storage, and possibly a few new ones may be formed.

Cause.—The cause of scurfy sweet potatoes is a fungus known as Monilochaetes infuscans Hals. The fungus affects only the skin of the potato, and is so superficial as to be readily scraped off by the finger nail. The fungus causing scurf, like several other field diseases of sweet potatoes, is largely carried to the field on the sprouts. From these it reaches the roots, and in this manner is spread to the new crop. The fungus lives through the winter on the potatoes in storage and on the decayed vines in the field.

Fig. 9. Scurf, or soil stain, of sweet potato. Note the spots and coalescing discoloration caused by the scurf fungus.
Control.—Scurf may be controlled by treating the seed potatoes with corrosive sublimate, as indicated on page 4. In addition, healthy seed, clean soil in the beds, and crop rotation should be employed. The disease is worse on low, poorly drained soils and on soils heavily manured. Such land should be avoided.

SCLEROTIAL ROT.
(Blight or Wilt.)

Prevalence.—A number of sweet potato beds were examined by the writer the past spring in the southern part of the State, and in many instances a rather high percentage of plants were found to be infected with a disease known as sclerotial-rot. This trouble, also called blight, wilt, or crown rot, sometimes produces a serious injury to the plants in the beds.

Symptoms.—Sclerotial-rot is characterized by a rotting of the plant stem just at, below, or above the surface of the ground. At the base of the stems and the ground around them for a distance of 2 or 3 inches, the disease produces a moldy, white growth. This moldy growth usually develops numerous hard, round bodies, called sclerotia, about the size of a mustard seed. These may be white at first but later become yellowish, then brown, and finally black when old. Sclerotial-rot is caused by the fungus Sclerotium rolfsii Sacc.

Control.—The disease is seldom serious enough to warrant the use of control measures. Occasionally, in beds which are poorly drained and where the plants are growing crowded together, it may cause some damage. Very little injury should result where good seed-bed practice is used.

TEXAS ROOT-ROT.

Economic Importance—Texas root-rot, so far as known, has not as yet been found in Mississippi. In Texas this disease commonly occurs, and is often destructive to sweet potatoes there. It is said to be worse in that State on the black, poorly drained soils, and during periods of wet weather. Root-rot enters the plants on the underground parts, and may spread deep into the roots or extend upward for a few inches into the stems and vines. Occasionally a slight yellowing and unhealthy appearance of the leaves are noted, which may be accompanied by wilting. The disease enters the potatoes, producing spots, which finally results in a firm, shrunk brown rot. Texas root-rot also attacks cotton, alfalfa, cowpeas, and certain orchard fruits.

Cause.—Root-rot is caused by the fungus Ozonium omnivorum (Pam.) Shear. The organism lives by means of hyphae, from one season to the next in the soil on decayed roots of sweet potato, alfalfa, etc. The fungus produces only sterile mycelia, or hyphae, although Duggar (4), reports the presence of a fruiting stage, which he calls Phomatrichium omnivorum (Shear) Dug., or the fruiting stage of Ozonium omnivorum. According to Taubenhaus (5), the Texas root-rot fungus is a sterile organism, and overwinters from year to year as sterile mycelium on dead roots of sweet potatoes and other plants.

Control.—Because of the great variety of plants attacked by root-rot, it is difficult to control. Since the disease is more prevalent on heavy, alluvial soils, such land should not be used for planting. A thorough system of rotation is also necessary, and in addition to sweet potatoes, this should also preclude the planting of such crops as cotton, okra, and alfalfa for several years. Grain crops are not affected by the disease, and may be planted.

SOIL-ROT.
(Pox or Pit.)

Economic Importance.—Soil-rot, perhaps better known as “pox” or “pit,” is another important field disease of sweet potatoes. The writer has not as yet however, any evidence of the disease existing in Mississippi, and at present it
is of no economic importance. In Delaware, Texas, and other states, it is considered a serious disease of the crop. Reduction of yields and the formation of ill-shaped potatoes are the important effects of this disease.

Symptoms.—Soil-rot attacks the roots, and at harvest infection may be observed frequently near the middle of the potatoes in the form of dark, round, roughened spots on the surface. After the potatoes are harvested and placed in storage, the infected areas may become dry and fall out, thereby assuming a pitted or pox-like appearance (Fig 10). The feeding roots are also frequently entirely destroyed. According to Elliott (6), soil-rot is caused by a slime mold, Cytospora batatas, Elliott.

Control.—At present very little data are available as to remedial measures for soil-rot; yet Taubenhaus states that the disease is not carried with the sweet potatoes, and after the pox spots dry and drop off, as is the case in storage, such potatoes when used for seed will produce healthy plants. It is probably advisable to treat (See page 4) soil-rotted seed as a precaution against other diseases that may be present. Soil-rot also attacks Irish potatoes, beets, turnips, and perhaps tomatoes (7). Hence, it becomes necessary in the case of infected soils not to plant these crops thereon, as well as sweet potatoes, for at least three or four years.

LEAF DISEASES.

Occurring in nearly every sweet potato growing district are three leaf diseases of sweet potatoes. These are leaf-blight caused by the fungus Phylllosticta batatis Taub., leaf spot caused by the fungus Septoria bataticola E. and M., and white-rust caused by the fungus Albugo ipomeae-panduranae (Schw.) Sw. All of these troubles produce more or less spotting of the foliage, but because of their minor importance they will not be discussed here.

STORAGE-ROTS.

A conservative estimate of the percentage reduction from the normal yield of sweet potatoes in Mississippi as the result of storage-rots is fully 25 or 30 percent. There is no doubt but that growers in the State would be able to market a much greater quantity of sweet potatoes if the losses resulting from storage-rots could be reduced to a minimum.
SOFT-ROT.

Economic Importance.—In a number of sweet potato storage houses which lose heavily from rots, most of the loss may be attributed to soft-rot. It is doubtless the most prevalent and destructive of the storage-rot organisms.

Symptoms.—Soft-rot, as the name implies, cannot be mistaken for any other disease; it produces a soft decay of the potatoes. It may start at either end of the potato and in the presence of high humidity and high temperature, the latter becomes soft and mushy (Fig. 11). In a few days, the entire potato may be totally destroyed. Soft-rotted potatoes soon lose their moisture and become hard and brittle. Growers frequently call this stage "dry-rot," whereas it is merely the after effects of soft-rot.

Cause.—The common bread mold, Rhizopus nigricans Ehr., is the fungus causing soft-rot. It abounds everywhere, growing readily in damp places, and on various decaying substances. Hence, it is almost impossible to exclude it from the storage house. If the skin of an infected potato is broken while soft and watery, the fungus may form a luxuriant, moldy growth (mycelium) on the surface. This is seen at the top of Fig 11. The organism usually gains entrance to the potato through wounds on the surface or at the ends where it was detached from the vine.

RING ROT.

(Ring-Rot.)

Ring-rot is often encountered in the storage house. It is caused by the same mold (Rhizopus nigricans) that produces soft-rot, but differs from the latter in that the decay begins at a point between the ends rather than at the ends. The infection starting at such a point often forms a ring or collar around the potato, and may at the same time progress slowly toward the ends. Decays of this nature are sometimes retarded in growth by unfavorable conditions,
such as low temperature and low humidity, and instead of engrossing the entire potato, merely a ring or collar is formed (Fig 12.)

Fig. 12. Ring-rot of sweet potato, a type of rot often encountered in the storage house.

BLACK-ROT.

Black-rot caused by the fungus *Sphaeronema fimbriatum* (E. & H.) Sacc., has already been discussed under field diseases (See page 2). It also constitutes one of the major storage-rot troubles, being probably second in importance to soft-rot. Frequently sweet potatoes are placed in storage that are slightly infected with tiny almost invisible black-rot spots. Under conditions of high temperature and humidity, these spots may gradually enlarge and form the dark, round spots on the potatoes as indicated in figure 2. The fruiting bodies (pycnidia) are produced near the center of the spots, and in these the spores of the fungus are produced. These are finally discharged and may be disseminated to other potatoes, in which the rot may develop again if conditions are favorable.

Fig. 13. Java black-rot. A sweet potato decayed by the Java black-rot fungus. Note the numerous domelike fruiting bodies of the fungus on the surface.
MINOR STORAGE-ROTS.

There are other diseases such as Java black-rot (caused by the fungus Diplodia tubericolor (E. and E., Taub.) (Fig. 13), dry rot (Diaporthe batatatis (E. and E.) Harter and Field (Fig. 14), and charcoal rot (Sclerotium bataticola Taub.), which may attack the sweet potato in storage. These are, however, usually secondary and follow primary infections of black-rot and soft-rot; and because of their minor importance detailed discussion concerning them is here omitted.

**Control of Storage-Rots.**—To control the principal storage-rot organisms, which have been mentioned above, it is first essential for the grower to equip himself with a modern storage house.* Scarcely any degree of success can be had unless this is available. In addition to a well regulated system of storage, there are other factors necessary for successfully controlling storage-rots. These are summarized as follows:

I. Eliminate the field diseases as far as possible by the control methods already mentioned. Some of these, like black-rot, also spread in storage while others, as stem-rot and foot-rot, may induce storage-rot organisms to enter the potatoes.

II. Dig the potatoes during bright clear days just before frost, and allow them to dry thoroughly in the sun. It is advisable to begin digging operations a few days preceding a heavy frost; heavy frosts may injure some of the potatoes, and these are difficult to keep in storage. During harvesting, avoid bruising and otherwise injuring the potatoes as much as possible, since bruised surfaces afford an entrance for soft-rot and other storage-rot organisms.

III. After the potatoes have been dried in the sun, as much as weather conditions will permit, place them in clean, open crates and remove to the storage house. Storing in crates is preferable to storing in bins, since with the former the potatoes have better ventilation, become less bruised than when dumped into bins, and are much easier to handle when ready for market.

IV. Storage houses in which potatoes were stored the previous year should always be thoroughly disinfected before receiving the new crop. Unless

*Plans for the construction of sweet potato storage houses may be obtained from the Extension Division, Miss. A. & M. College, or the Bureau of Markets, U. S. Department of Agriculture, Washington, D. C.
this is done, the potatoes may come in contact with spores of the various soft-
rot organisms remaining from last season. After houses have been cleared of
all rubbish and other debris, they should be sprayed down with a suitable fun-
gicide, such as copper sulphate, formalin, or lime-sulphur. Copper sulphate
may be used at the rate of 1 pound to 25 gallons of water, or formalin in the
proportion of 1 pint commercial formalin to 30 gallons of water. Good success
is often attained by merely white-washing the houses, but such a disinfectant
is perhaps more effective if a winter-strength solution of lime-sulphur is added.

V. After the above mentioned suggestions have been followed, success in
curing potatoes properly and preventing the development of storage-rots de-
pend upon the management of the storage house. During the first two
weeks of curing, the temperature of the storage house should be high, namely,
from 80 degrees to 85 degrees F. This aids in curing the potatoes and dries
off surplus moisture. The ventilators should be handled so that the moisture
given off by the potatoes is carried out of the house. After ten days or two
weeks of curing, the temperature of the house should be gradually lowered to
50 degrees or 55 degrees F, and this maintained as far as possible during the
remainder of the storage period. The main plan is to keep the house dry and
as near 50 or 55 degrees F as possible. During the cold months the house
should be carefully watched as to temperature and humidity conditions. If
moisture accumulates, this must be gotten out of the house by opening the
ventilators at the top and admitting dry air from below.

LITERATURE.

   Dept. of Agr.

2. Harter, L. L., The Foot-Rot of the Sweet Potato, Jour. of Agr. Re-
   search 1:251-274, 1913.

3. McClintock, J. A., Sweet Potato Diseases, Va. Truck Exp. Station,


7. Taubenhaus, J. J., Pox or Pit (Soil-Rot) of the Sweet Potato, Jour.